

■ ■ ■ ■ ■ ■ ■ SEDIMENT INTERIM
REMEDIAL
MEASURES REPORT
Pawtuxet River

July 31, 1996

Submitted by:

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1.1 OVERVIEW

This report presents the results of the Sediment Interim Remedial Measure (IRM) that was conducted at the former CIBA-Geigy (Ciba) Site in Cranston, Rhode Island from October 1995 through April 1996. This report summarizes the preliminary tasks and proposed work; discusses sediment removal, treatment, and disposal; and presents post-excavation sampling results for the IRM.

1.2 PROJECT BACKGROUND

This section describes the Site history and provides background information on the Interim Remedial Measures (IRMs) that have been implemented. It also presents the objectives of the Sediment IRM.

1.2.1 Site History

Beginning in 1930, the Alrose Chemical Company manufactured chemicals at the Site. The GEIGY Chemical Company of New York purchased the Site in 1954 and merged with the Ciba Corporation in 1970; thereafter, the Site was used for batch manufacturing of organic chemicals. Over time, the following major product categories were manufactured:

- 1950s--agricultural products, as well as leather and textile auxiliaries;
- 1960s--plastics additives, optical brighteners, pharmaceuticals, and textile auxiliaries;
- 1970s--agricultural products, plastics additives, pharmaceuticals, textile auxiliaries, and bacteriostats; and,
- 1980s--plastics additives and pharmaceuticals.

By May 1986, Ciba had ceased all chemical manufacturing operations at the Site and had begun decommissioning and razing the plant. The Site has been divided into three study areas: the Production Area, the Warwick Area, and the Waste Water Treatment Area. The boundaries of these three areas are shown on Figure 1-1. The Pawtuxet River, an off-site area, runs through the Site.

1.2.2 History of the Interim Remedial Measure

Prior to 1975, wastewater from manufacturing operations were discharged to a cofferdam adjacent to the bulkhead in the Production Area. The cofferdam was a baffled wooden solvent recovery structure which provided residence time for the wastewater and allowed for free phase solvents to float to the surface and be collected by a skimmer. The cofferdam was approximately 8 feet wide by 50 feet long and was located adjacent to the Production Area bulkhead as shown Figure 1-2. It was taken out of service and decommissioned after Ciba's on-site wastewater treatment plant was put into service in 1975.

During the RCRA Facility Investigation (RFI), sediment within the Former Cofferdam Area was identified as possessing different physical and chemical characteristics from the rest of the river

sediment. This sediment had a different consistency and stained the sampling equipment. During Phase II of the RFI, the highest concentrations of contaminants were detected in these sediments. The Volatile Organic Compounds (VOCs) chlorobenzene and toluene were detected at high levels in the surface sediments. Semi-volatile Organic Compounds (SVOCs) naphthalene and bis(2-ethylhexyl)phthalate were also detected. PCBs were detected at elevated concentrations in the surface sediment. Based on these results, Ciba elected to conduct a Sediment IRM to excavate, treat, and dispose of these impacted river sediments.

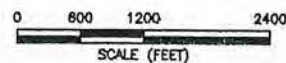
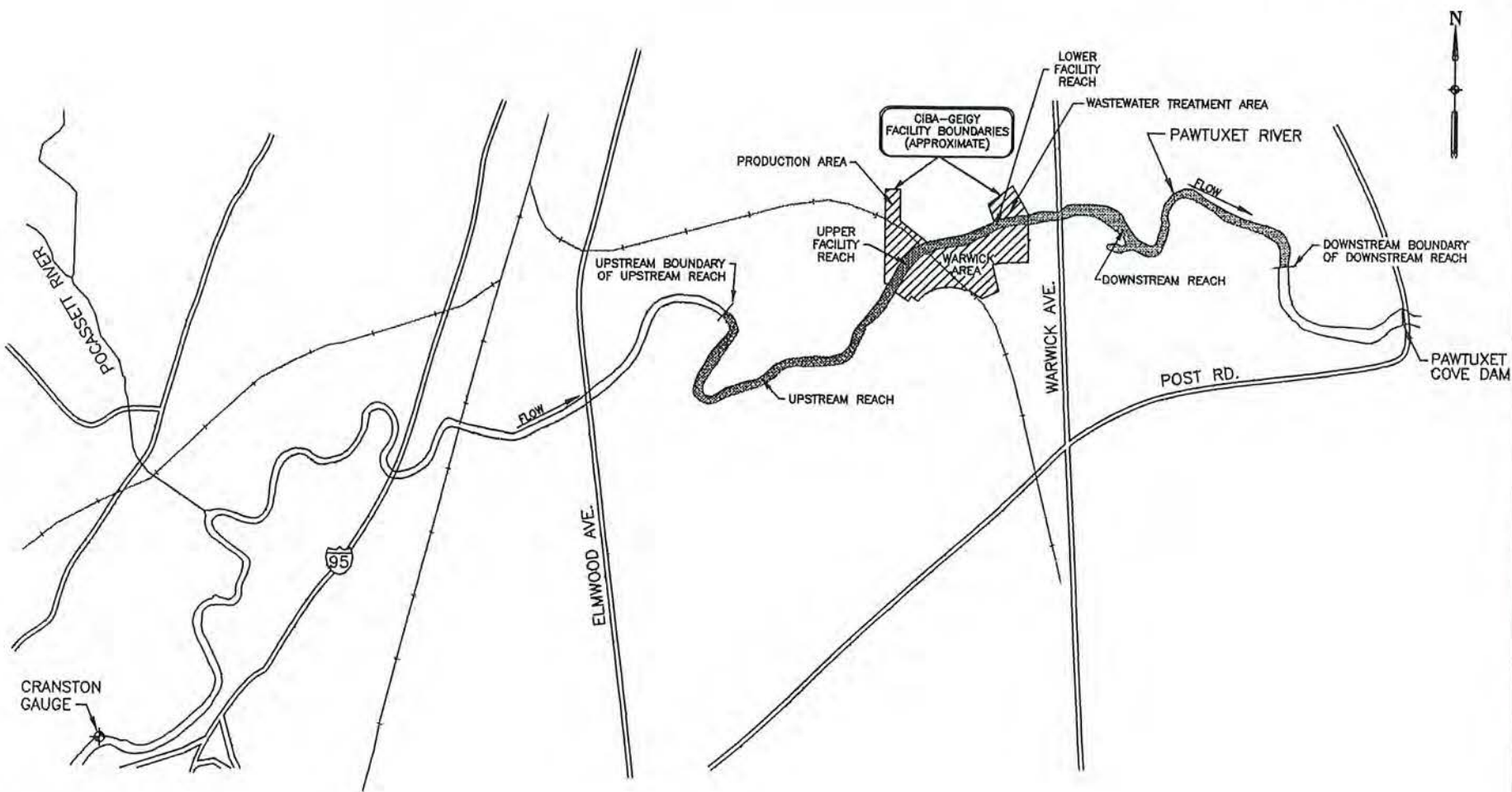
Prior to conducting the Sediment IRM, a Workplan (Conceptual Design Workplan, Cranston Site, Cofferdam Remedial Measure) describing the strategy, methods and procedures for performing this work was prepared and submitted to United States Environmental Protection Agency (USEPA), Rhode Island Department Environmental Management (RIDEM), and the United States Army Corp of Engineers (USACOE) in May 1995. Comments generated by these agencies were addressed prior to this investigation. The Sediment IRM was performed in the Fall and Winter 1995. A performance specification was prepared by Ciba and its consultants to remove visually contaminated sediment from the Former Cofferdam Area. No MPS or quantitative sediment quality criteria were developed for this investigation. After the bids were evaluated, Severson Environmental Services, Inc. (SES) was selected to implement the Sediment IRM.

The Sediment IRM was performed voluntarily. It was one of several voluntary IRMs performed as part of the Site RCRA Corrective Action. Two other IRMs have been implemented by Ciba at the Site. An On-Site Soil IRM was conducted to excavate and dispose of PCB-contaminated soil from the Production Area and Warwick Areas. Also, a Stabilization IRM was implemented to control contaminated groundwater from discharging to the Pawtuxet River. The Stabilization components included a groundwater capture system, a groundwater pretreatment system, and a soil vapor extraction system.

1.3 OBJECTIVES OF THE PAWTUXET RIVER SEDIMENT IRM

The objectives of the Sediment IRM are summarized here. The main objectives of this investigation included:

- Remove visually contaminated sediment from the Former Cofferdam Area where wastewater from plant operations was discharged historically;
- Mitigate sediment and surface water toxicity by reducing the mass of organic contaminants (especially PCBs and chlorobenzene) within the Former Cofferdam Area; and,
- Backfill the excavated areas with clean fill to provide an uncontaminated substrate for benthic invertebrates.



Job No. 87X4650-16.30
Prepared by: TP
Date: 06/26/1996

THE PAWTUXET RIVER REACHS:
UPSTREAM, FACILITY, AND DOWNSTREAM
COFFERDAM IRM
CRANSTON, RHODE ISLAND

FIGURE 1-1



FIGURE 1-2
FORMER COFFERDAM

Several preliminary tasks were performed as part of this Sediment IRM. These tasks included identifying limits of areas to be excavated, classifying the sediment for waste characteristics, and identifying permit requirements. A summary of each of these tasks is presented here.

2.1 IRM DELINEATION

Based on the results of elevated levels of VOCs and PCBs in the vicinity of the Former Cofferdam Area, Ciba elected to conduct an IRM in the Pawtuxet River. A sediment probing study was designed and conducted to identify the area of excavation in the river.

2.1.1 Sediment Probing Study

Ciba conducted a Sediment Probing Study between September 27 and October 13, 1994 to visually delineate the vertical and horizontal extent of contaminated sediment in the Former Cofferdam Area (Appendix A). Sediments were probed on a five-foot grid, over an area approximately 150 feet long and 50 feet wide (Figure 1, Appendix A). A probe was forced into the sediment using a weighted driver to maximize penetration. Using this method, sediment thickness up to 7.5 feet was measured.

Figure 2-1 depicts the depth below the river bed to visually observable contaminated sediment. The sediment probing results indicated two visibly stained areas, one approximately 40 feet by 100 feet near the upstream end of the Former Cofferdam and a second area, approximately 35 feet by 45 feet, near the downstream end. The visibly stained sediments were first encountered at depths ranging from 0.5 to 4.5 feet below the river bed. The Sediment Probing Study revealed that the areal extent of visually contaminated sediments was limited to the immediate area of the Former Cofferdam adjacent to the former Production Area. Detailed results of this study are included in Appendix A.

2.1.2 Chemical Analysis and Treatability Testing of River Sediment

Following the Sediment Probing Study, Ciba conducted a sampling event to evaluate the nature of the sediment contamination in the Former Cofferdam Area. Between January 17 and 19, 1995 sediment samples were collected from 20 locations in the Pawtuxet River Upper Facility Reach. Representative samples were collected from both the most visually contaminated areas observed and from areas where contamination was not observed during the Sediment Probing Study, as shown on Figure 2-2. These locations were also sampled at various depths to determine the extent of contamination. The samples were analyzed for the full toxicity characteristic leaching procedure (TCLP) parameters, organic pesticides, and PCBs, as described in Table 2-1. Sufficient sediment sample volume was collected for subsequent treatability testing. The treatability testing included filtration, dewatering, and stabilization.

The data in Table 2-2 indicate that the sediment samples were RCRA non-hazardous because the samples did not exceed TCLP regulatory levels. Total VOC and SVOC data in Table 2-3

indicate the sediment sample from location SD-1C had the highest total VOC concentration at just over 27,000 ppm. SVOCs were not detected in this sample. With the exception of composite sample SD-1-2(A,B,C), which had a SVOC concentration of 852 ppm, most other samples had low (or not detectable) concentrations of SVOCs. The highest PCB concentration at 34,000 ppm was found in Sample SD-5C, as shown in Table 2-4.

Overall, results of the chemical analysis and treatability testing indicated:

- Visually-impacted sediments contain elevated concentrations of mostly volatile organics which potentially represent prior wastewater discharges.
- High PCB levels are also found at some locations but not necessarily consistent with past discharges.
- The sediments were primarily determined not to be a RCRA characteristic hazardous waste.
- Constituent concentrations were variable throughout the target zone, but for the most part coincided with areas of greatest visual contamination.

2.2 SEDIMENT WASTE CLASSIFICATION

From May 31 to June 1, 1995, prior to excavation, Ciba collected 16 composite sediment samples from the sediment for waste disposal classification purposes as shown in Figure 2-3. Sixteen samples were collected from a pre-determined grid in the Former Cofferdam Area. Sediment samples were collected from the center and each corner of these grids and to a depth of 4 feet. The sediment collected from the five points of each grid were composited.

The sediment composite samples were analyzed for the TCLP parameters (VOCs, SVOCs, Pesticides/Herbicides, and Metals) as shown in Table 2-5. The TCLP results indicated that sample SD-WCC-7 exceeded the 100 mg/l TCLP criterion for chlorobenzene. Accordingly, and in order to be conservative, Ciba elected to classify the sediment in the entire SD-WCC-7 grids as RCRA hazardous for chlorobenzene (D021). The other fifteen samples were classified as RCRA non-hazardous.

In May 1995, sediment from the Former Cofferdam Area was sampled for waste characteristics. Based on these sampling results, a small portion of the Former Cofferdam Area was classified as a RCRA characteristic waste.

2.3 PERMITTING

The Sediment IRM activities would include dredging in the Pawtuxet River and the processing of sediment and water. These activities would require several permits from local, state, and federal agencies. Based on the IRM activities, the following permits would need to be obtained

- Clean Water Act - Section 404 Permit for the Discharge of Dredged or Fill Material (404 Permit);
- Rhode Island Freshwater Wetlands Permit - Site Remediation Exemption;
- Clean Water Act Section 401 Water Quality Certification;
- City of Cranston Soil Erosion and Sediment Control Permit; and
- City of Cranston Industrial Wastewater Discharge Permit.

The permits are described in detail in Section 3.2. Approvals and permit correspondence are included in Appendix C.

2.4 PROPOSED ACTIVITIES

After the visually contaminated area of sediment was identified, Ciba proceeded to develop a Workplan (Conceptual Design Workplan, Cranston Site, Cofferdam Interim Remedial Measure) to implement the Sediment IRM. The Workplan was prepared and submitted to RIDEM, USEPA, and the USACOE in May 1995 (Appendix B). The design criteria specified a sealable sheet piling system to isolate the area of contamination and minimize the impacts to the surrounding water column during excavation activities. Prior to and during sheet pile installation and removal, a silt curtain would be used to protect the water column. An independent sheet piling system would be installed on the original grid coordinates (10 ft. by 40 ft.) to isolate the sediment classified as RCRA characteristic. This would provide the means to manage the sediment classified as RCRA characteristic waste independently from the other sediments.

Once installed, the temporary sheetpile cofferdam would be dewatered by pumping the captured water to the river. When the water level would be lowered to within one foot of the river bottom, the remaining water would be sent to a temporary on-site wastewater treatment unit. This wastewater treatment unit would remove solids via sand and cartridge filtration and remove VOCs via granular activated carbon (GAC), prior to discharging the water to the City of Cranston POTW.

Sediment would then be excavated from the Former Cofferdam Area using a crane and clam shell bucket to a depth of -3 feet MSL. During excavation, the water column outside of the silt curtain would be monitored for turbidity to insure that there would be no impacts to the river from excavation activities.

All excavated sediment would be stabilized with Portland cement prior to transportation to meet the landfill requirements. All excavated sediment from within the isolated RCRA containment area would be incinerated at a RCRA/TSCA permitted incinerator. All RCRA non-hazardous sediment, the bulk of excavated material, would be landfilled at a permitted RCRA/TSCA landfill.

During excavation and stabilization activities, air monitoring would be conducted at the facility fence line as well as in excavation and stabilization areas to insure protection of the public and Site workers.

2.5 CONTRACTOR SELECTION

Ciba prepared design plans and performance specifications for the Sediment IRM and initiated a bidding process to select a qualified contractor to implement the IRM. Bids were solicited from four contractors. Two bids were received and were evaluated. Ciba selected Severson Environmental Services, Inc. (SES) of Niagara Falls, New York to implement the Sediment IRM.

In accordance with the performance specifications, SES submitted various documents related to the IRM, including:

- A project Health and Safety Plan;
- A design package for the water treatment system; and
- An Operations Plan which described methods and materials SES proposed to use to implement the IRM (Appendix D).

TABLE 2-1
SEDIMENT SAMPLE SUMMARY - JANUARY 1995 SAMPLING
Sediment IRM
Ciba-Geigy Site
Cranston, Rhode Island

SAMPLE ID	SAMPLE DEPTH (ft)	DATE / TIME COLLECTED	SAMPLE ANALYSIS	COMMENTS
SD-1A(2-3)	2 - 3	1/19/95 0845	TCLP, Treatability Underlying Haz. Constituents	Old cofferdam area where visible evidence of staining was observed.
SD-1B(1-2)	1 - 2	1/18/95 1045	TCLP, Treatability Underlying Haz. Constituents	Old cofferdam area where visible evidence of staining was observed.
SD-1C(0-1)	0 - 1	1/17/95 1535	TCLP, Treatability Underlying Haz. Constituents	Old cofferdam area where visible evidence of staining was observed.
SD-1D(0-1)	0 - 1	1/19/95 1230	Treatability	Old cofferdam area where visible evidence of staining was observed.
SD-2A(1-2)	1 - 2	1/19/95 0950	TCLP, Treatability Underlying Haz. Constituents	Area shown from previous analyses to have elevated concentrations of chlorobenzene.
SD-2B(0-1)	0 - 1	1/18/95 1450	TCLP, Treatability Underlying Haz. Constituents	Area shown from previous analyses to have elevated concentrations of chlorobenzene.
SD-2C(2-3)	2 - 3	1/17/95 1415	TCLP, Treatability Underlying Haz. Constituents	Area shown from previous analyses to have elevated concentrations of chlorobenzene.
SD-2D(0-1)	0 - 1	1/19/95 1145	Treatability	Area shown from previous analyses to have elevated concentrations of chlorobenzene.
SD-3A(0-.5)	0-.5	1/18/95 1400	TCLP, Treatability Underlying Haz. Constituents	Outside edge of the visibly contaminated area identified in the probing study.
SD-3B(0-.5)	0-.5	1/18/95 0840	TCLP, Treatability Underlying Haz. Constituents	Outside edge of the visibly contaminated area identified in the probing study.
SD-3C(0-.5)	0-.5	1/17/95 1125	TCLP, Treatability Underlying Haz. Constituents	Outside edge of the visibly contaminated area identified in the probing study.
SD-3D(0-1)	0 - 1	1/19/95 1105	Treatability	Outside edge of the visibly contaminated area identified in the probing study.

Notes:

SD = Sediment

TCLP = Toxicity Characteristic Leaching Procedure (includes RCRA Characteristics).

Underlying Hazardous Constituents were composited from SD-1(A,B,C) and SD-2(A,B,C) for one sample (SD-1-2(A,B,C)) and from SD-3(A,B,C) (SD-3(A,B,C)) for another sample. VOA vials were collected from SD - 1(B+C), SD - 2(B+C) and SD-3(B +C).

Geotech samples were collected at SD - 1A + 1B, SD - 2A,B + C and SD-3A,B + C. No sample was collected from SD-1C due to excessive contamination.

Treatability samples were collected from 4 locations per sample area (SD-1, SD-2, SD-3).

TABLE 2-2
SUMMARY OF TCLP SEDIMENT ANALYSES DATA - JANUARY 1995 SAMPLING
Sediment IRM
Ciba-Geigy Site
Cranston, Rhode Island

Analyte	Regulatory Limit	SD-3(A,B,C)	SD-1-2(A,B,C)	SD-3C(0-0.5)	SD-2C(2-3)	SD-1C(0-1)	SD-3B(0-0.5)	SD-1B(1-2)	SD-3A(0-0.5)	SD-2B(0-1)	SD-1A(2-3)	SD-2A(1-2)
	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
VOCs												
chlorobenzene	100	NA	NA	ND	ND	66	3.6	35	0.28	50	12	0.038
tetrachloroethene	0.7	NA	NA	ND	ND	ND	0.04	ND	ND	ND	ND	ND
SVOCs												
1,4-dichlorobenzene	7.5	NA	NA	ND	ND	0.021	ND	0.041	ND	ND	ND	ND
cresol	200	NA	NA	ND	ND	3.8	0.033	0.47	ND	0.03	0.042	ND
nitrobenzene	2	NA	NA	ND	ND	0.28	0.0049	0.016	ND	ND	ND	ND
Metals												
barium	100	0.46	0.83	0.36	0.43	0.46	0.53	0.33	0.39	0.53	0.72	0.49
Pesticides												
heptachlor	0.008	NA	NA	ND	ND	ND	ND	0.000035	ND	ND	ND	ND
endrin	0.02	NA	NA	ND	ND	ND	ND	ND	ND	0.00032	ND	ND

ND = Not Detected

NA = Not Analyzed

Only detected paramaters are reported

TABLE 2-3
SUMMARY OF VOLATILE AND SEMI-VOLATILE ANALYTICAL DATA - JANUARY 1995 SAMPLING
Sediment IRM
Ciba-Geigy Site
Cranston, Rhode Island

Location Depth (feet)	SD-1-2(A,B,C)	SD-1B (1-2)	SD-1C (0-1)	SD-2A (1-2)	SD-2B (0-1)	SD-2C (2-3)	SD-3 (0-.5)	SD-3A (0-.5)	SD-3B (0-.5)
VOCs	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2-butanone	ND	ND	ND	ND	ND	1.2	ND	1.2	1.4
acetone	ND	ND	ND	ND	ND	ND	ND	ND	1.2
benzene	63	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	1200	910	14000	ND	2700	2.8	0.012	0.27	ND
chloroform	ND	ND	220	ND	ND	ND	ND	ND	ND
ethylbenzene	26	62	250	ND	100	ND	ND	ND	ND
methyl ethyl ketone	60	ND	ND	ND	ND	ND	ND	ND	ND
methylene chloride	ND	ND	320	ND	ND	0.19	0.024	0.21	0.38
tetrachloroethane	ND	ND	200	ND	ND	ND	ND	ND	ND
toluene	510	400	11000	ND	300	9.5	0.11	0.18	ND
total xylenes	89	150	1300	150	302	0.51	ND	ND	ND
Total VOCs	1948	1522	27290	150	3402	14.2	0.146	1.86	2.98
SVOCs									
acenaphthylene	ND	ND	ND	ND	ND	ND	ND	ND	ND
anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND
benzo(a)anthracene	ND	ND	ND	ND	ND	ND	1.2	ND	ND
benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND
benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	1.3	ND	ND
benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	0.46	ND	ND
benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	0.45	ND	ND
bis-2-ethylhexylphthalate	ND	ND	ND	ND	ND	ND	1.4	ND	ND
chrysene	ND	ND	ND	ND	ND	ND	1.1	ND	ND
di-n-octylphthalate	ND	ND	ND	ND	ND	ND	2.8	ND	ND
di-n-butylphthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND
fluoranthene	ND	ND	ND	ND	ND	ND	2.3	ND	ND
indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND	ND	0.48	ND	ND
naphthalene	72	ND	ND	ND	ND	ND	ND	ND	ND
o-dichlorobenzene	180	ND	ND	ND	ND	ND	ND	ND	ND
p-chloroaniline	600	ND	ND	ND	ND	ND	ND	ND	ND
phenacetin	ND	ND	ND	ND	ND	ND	0.92	ND	ND
phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND
pyrene	ND	ND	ND	ND	ND	ND	1.7	ND	ND
Total SVOCs	852	ND	ND	ND	ND	ND	14.11	ND	ND

ND = Not Detected

TABLE 2-4
SUMMARY OF PESTICIDES AND PCB ANALYTICAL DATA - JANUARY 1995 SAMPLING
Sediment IRM
Ciba-Geigy Site
Cranston, Rhode Island

Location Depth	SD-1-2 (A,B,C)	SD-1A (2-3)	SD-1B (1-2)	SD-1C (0-1)	SD-2A (1-2)	SD-2B (0-1)	SD-2C (2-3)	SD-3 (0-.5)	SD-3A (0-.5)	SD-3B (0-.5)	SD-3B (1-2)	SD-3C (0-.5)	SD-3C (1-2)	SD-4B (0-.5)
Pesticides/PCBs	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
4,4'-DDE	0.094	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1221	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.26
1232	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.076	ND	ND	ND	ND
1242	ND	10	24	120	0.033	5.3	1.8	ND	0.049	0.12	0.12	0.1	ND	ND
1248	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.38
1254	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.21	ND	ND	2.3	0.08
1260	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.032
Total PCBs	0.094	10	24	120	0.033	5.3	1.8	0	0.049	0.406	0.12	0.1	2.3	0.752
Location Depth	SD-4B (1-2)	SD-4C (1-2)	SD-4C (2-4)	SD-5B (1-2)	SD-5B (3-4)	SD-5C (1-2)	SD-5C (3-4)	SD-5C (4-6)	SD-5D (1-2)	SD-5D (2-4)	SD-5D (4-6)	SD-6B (0-.5)	SD-6B (1-2)	SD-6C (1-2)
Pesticides/PCBs	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
4,4'-DDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1221	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.9	ND	ND
1232	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1242	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1248	0.11	0.12	0.27	ND	ND	34000	5400	0.013	0.36	0.82	0.16	2.2	1.5	0.11
1254	0.08	0.081	0.1	0.038	0.14	ND	ND	ND	ND	ND	ND	1.4	ND	ND
1260	0.032	ND	ND	0.021	0.16	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total PCBs	0.222	0.201	0.37	0.059	0.3	34000	5400	0.013	0.36	0.82	0.16	11.5	1.5	0.11

Note: ND = Not Detected

TABLE 2-5
WASTE CHARACTERIZATION SAMPLING - SPRING 1995
Sediment IRM
Ciba-Geigy Site
Cranston, Rhode Island

	TCLP-LIMIT ug/l	WC-1 ug/l	WC-2 ug/l	WC-3 ug/l	WC-4 ug/l	WC-5 ug/l	WC-6 ug/l	WC-7 ug/l	WC-8 ug/l	WC-9 ug/l	WC-10 ug/l	WC-11 ug/l	WC-12 ug/l	WC-13 ug/l	WC-14 ug/l	WC-15 ug/l	WC-16 ug/l
VOCs																	
Vinyl chloride	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	200,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	6,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	500	91	ND	ND	ND	ND	ND	27J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	700	13J	ND	ND	ND	ND	ND	78	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	100,000	41,000	2,000	89	15J	10,000	22,000	130,000	500	75	85	26J	16J	390	9,100	3,200	44J
SVOCs																	
1,4-Dichlorobenzene	7,500	ND	ND	ND	ND	14J	13J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Cresol	200,000	290	ND	ND	ND	94	120	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane	3,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	2,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	2,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	400,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	130	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	130	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	100,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyridine	5,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HERBICIDES																	
2,4-D	10,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,5-TP (Silvex)	1,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PESTICIDES																	
Gamma BHC (Lindane)	400	ND	ND	ND	ND	ND	0.23	ND	ND	ND	ND	ND	ND	ND	ND	0.046	ND
Heptachlor	8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endrin	20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methoxychlor	10,000	ND	1.3	2.3	ND	ND	ND	1.4	ND	ND	ND	ND	ND	ND	ND	0.15	ND
Chlordane	30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toxaphene	500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
METALS																	
Arsenic	5,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	100,000	460	590	350	320	560	350	450	400	380	390	300	470	700	320	310	440
Cadmium	1,000	ND	ND	ND	ND	ND	ND	ND	ND	57	ND	ND	ND	30	ND	ND	ND
Chromium	5,000	ND	ND	ND	ND	ND	ND	ND	ND	100	ND	ND	ND	170	ND	ND	ND
Lead	5,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	470	ND	ND	ND	ND
Mercury	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	120	ND	ND	ND	ND	ND	ND
Selenium	1,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	5,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = Not detected

FIGURE 2-1

DEPTH TO VISUAL CONTAMINATION BELOW RIVER BED

PAWTUXET RIVER (COFFERDAM AREA)

CIBA-GEIGY FACILITY

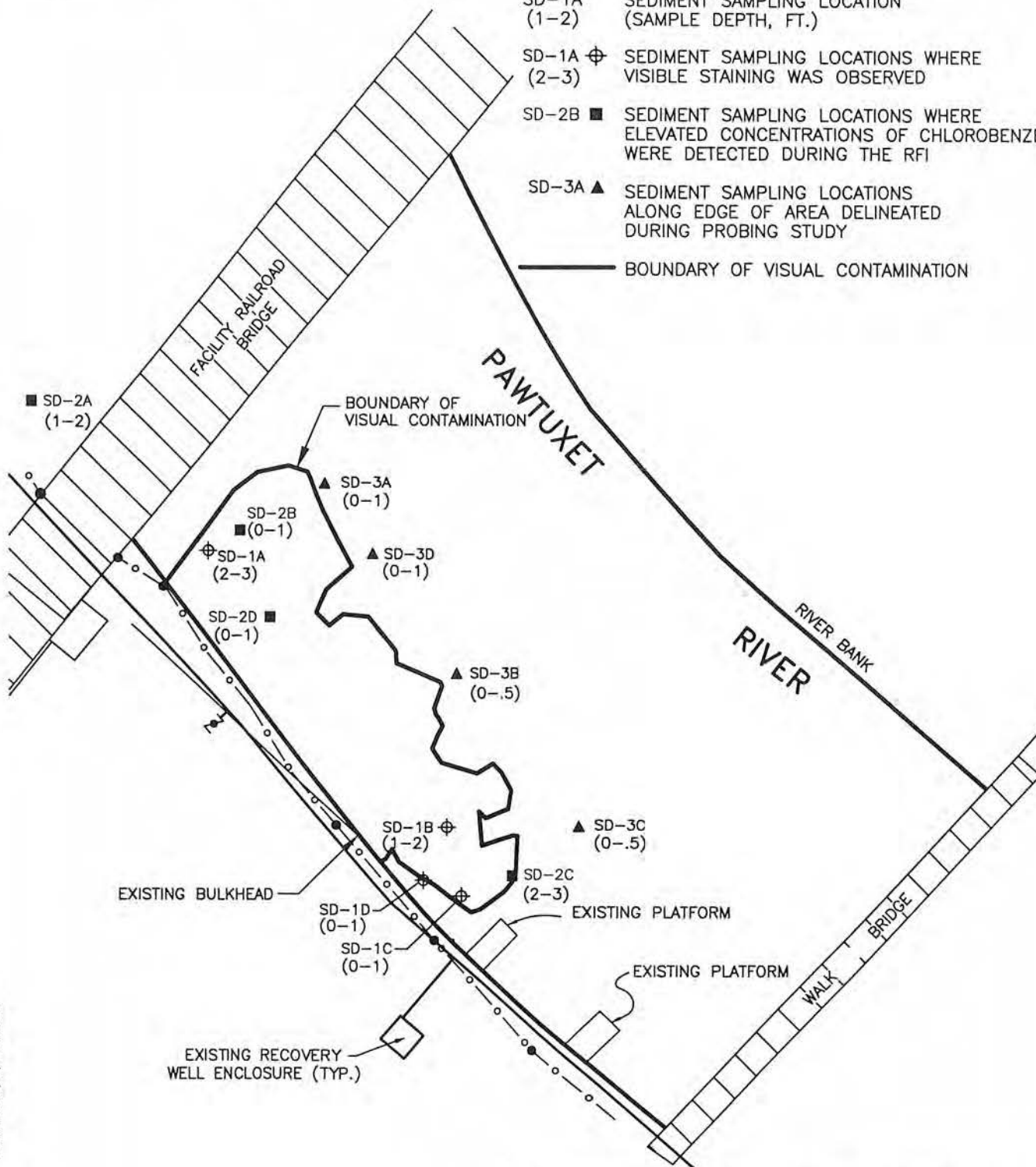
CRANSTON, R.I.





LEGEND:

- SD-1A (1-2) SEDIMENT SAMPLING LOCATION (SAMPLE DEPTH, FT.)
- SD-1A ⊕ SEDIMENT SAMPLING LOCATIONS WHERE VISIBLE STAINING WAS OBSERVED
- SD-2B ■ SEDIMENT SAMPLING LOCATIONS WHERE ELEVATED CONCENTRATIONS OF CHLOROBENZENE WERE DETECTED DURING THE RFI
- SD-3A ▲ SEDIMENT SAMPLING LOCATIONS ALONG EDGE OF AREA DELINEATED DURING PROBING STUDY
- BOUNDARY OF VISUAL CONTAMINATION



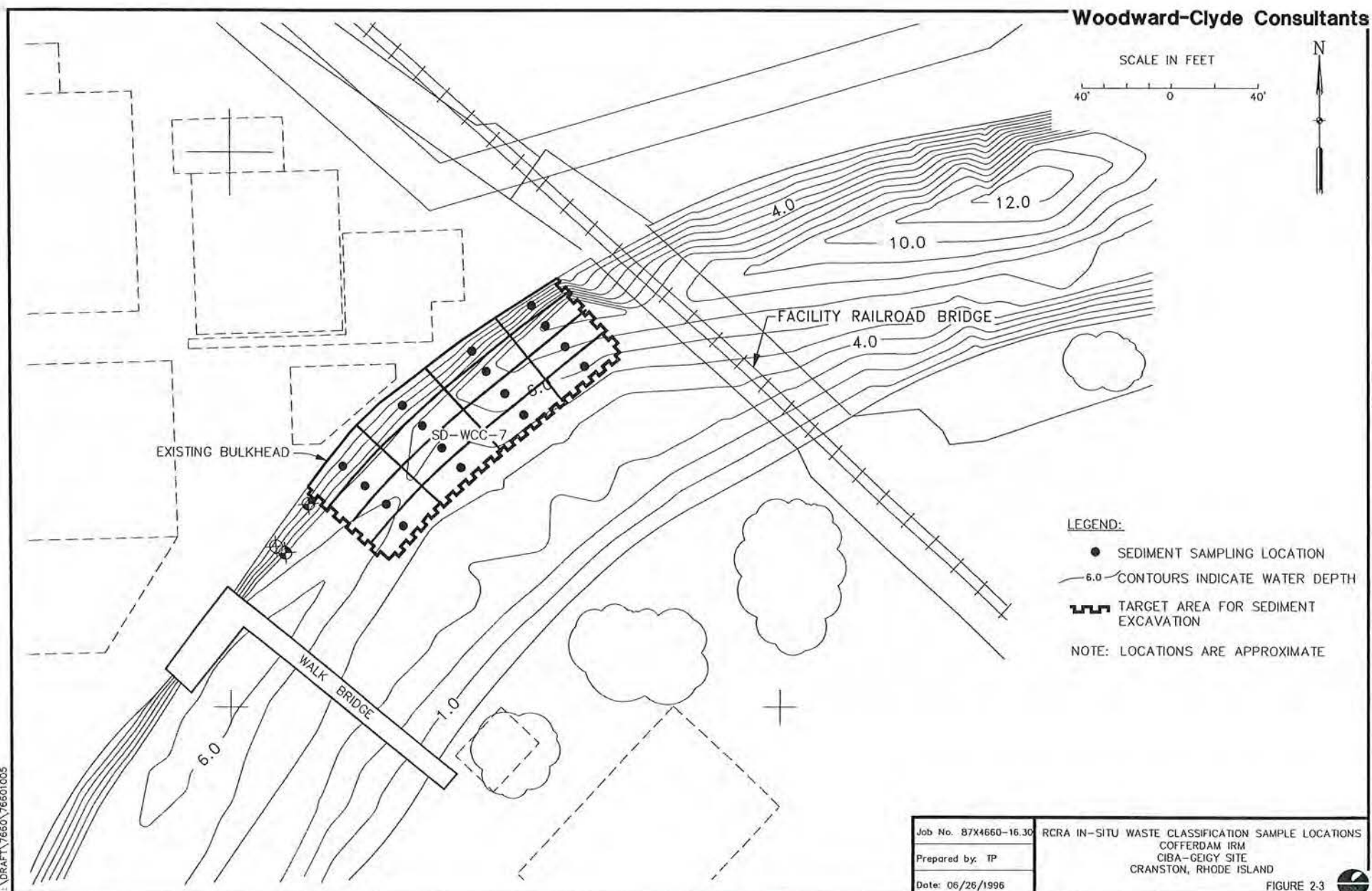
0 20 40 80
SCALE (FEET)

SEDIMENT SAMPLING LOCATIONS
JANUARY 17-19, 1995
CIBA-GEIGY SITE
CRANSTON, RHODE ISLAND

WOODWARD-CLYDE CONSULTANTS

ENGINEERING & SCIENCES APPLIED TO THE EARTH & ITS ENVIRONMENT
WAYNE, NEW JERSEY

DR. BY	FWD	SCALE	1" = 40'	DWG. NO.	74680113	PROJ. NO.	87X4660
CK'D. BY	EMH	DATE	JULY 9, 1998	FIG. NO.	2-2		



This section provides an overview of the regulatory agency approvals and permits required to perform the sediment IRM. This section also summarizes the activities performed in the Pawtuxet River. Selected photos of these activities are included at the end of this section.

3.1 REGULATORY APPROVALS

In order to implement the Sediment IRM, Ciba needed approvals from a federal and state regulatory agencies. Ciba initially contacted agency representatives from RIDEM and USEPA in February of 1995 to discuss the conceptual approach to performing this work. The Workplan was submitted to the agencies in May 1995.

Ciba received and responded to comments generated by both agencies, which were either general, or dealt with operational procedures, sampling procedures, or data validation. All issues were addressed satisfactorily. In a letter dated August 23, 1995, RIDEM approved the Workplan as an Interim Remedial Measure, subject to the provisions specified in this approval letter and subsequent modification letters. This approval was necessary to satisfy federal, state, and local permitting requirements. USEPA was not required to approve this voluntary IRM under RCRA regulations. Correspondence between Ciba and the various regulatory agencies is included in Appendix C.

3.2 PERMITS

In addition to regulatory agency approvals, Ciba identified the need to acquire a number of permits to implement the Sediment IRM. The Workplan identified the following permits that were required to implement the project:

- Clean Water Act - Section 404 Permit for the Discharge of Dredged or Fill Material (404 Permit);
- Rhode Island Freshwater Wetlands Permit - Site Remediation Exemption;
- Clean Water Act Section 401 Water Quality Certification;
- City of Cranston Soil Erosion and Sediment Control Permit; and
- City of Cranston Industrial Wastewater Discharge Permit.

These permits, and the process for obtaining them, are described in detail in the following sections.

3.2.1 Section 404 Permit

Since this project involved the excavation and discharge of fill material into the waters of the United States (the Pawtuxet River), a Section 404 Permit under the Federal Clean Water Act was required. These permits are issued by the United States Army Corps of Engineers (USACOE). The project qualified for Nationwide Permit (NWP) 38 because it was a remediation project

under the supervision of a government agency, RIDEM. The NWP 38 is a permit notification which can be approved by the USACOE in as little as 30 days.

In order to facilitate the approval of the NWP 38 application, Ciba had a pre-application meeting with the USACOE in April of 1995. At that meeting, the USACOE identified potential issues that needed to be resolved. These concerns were then addressed in the design of the project.

The USACOE's major concern was the management of contaminated sediments that would be disturbed during the project. The silt curtain/sheetpile construction and an in-river turbidity monitoring program satisfied the agency's concerns. Ciba submitted the permit application on June 6, 1995. The USACOE issued the permit on June 20, 1995, two weeks after the application was submitted.

3.2.2 Rhode Island Freshwater Wetlands Permit

Rhode Island regulates activities in rivers and along river banks under its Freshwater Wetlands Program. Since this project involved work within 200 feet of a river bank along a river greater than 10 feet in width and work in the channel of the river itself, the project was subject to regulation under the Freshwater Wetlands Act. The project was eligible for an exemption from the permitting requirements of the Act because it was a hazardous waste remediation project under the supervision of RIDEM's Division of Site Remediation.

In addition to the concerns regarding the contaminated sediment, RIDEM was also concerned about the effect that the temporary cofferdam structure would have on the river's flood flow capacity. To address this issue, Ciba engaged HydroQual to perform a modeling study to show that the structure would not have any significant impact on the river's flood capacity. In response to this study, RIDEM established a permit requirement that any work to be performed in the river must be performed during low flow conditions.

3.2.3 Section 401 Water Quality Certificate

This project required a 401 Water Quality Certificate (WQC) because it involved work with the potential to impact the quality of waters of the United States. The WQC is a federal program that was delegated to the states. As with several of the other permits, the major concern for RIDEM was also the management of contaminated sediments that were disturbed during the installation of the sheetpiling and the excavation of the sediment. As they had satisfied the USACOE, the silt curtain/sheetpiling design and in-river turbidity monitoring program satisfied RIDEM's concerns.

In addition to the concerns about the contaminated sediments, RIDEM also had some concerns about the impact of dewatering of the area inside the sheetpiling on fish and other aquatic animals. This was particularly a concern for those animals that were caught inside the sheetpiled area. To eliminate this concern, Ciba agreed to remove as many of the fish and other animals as was practicable before completing the dewatering.

The WQC is usually issued in conjunction with other state permits. RIDEM issued the WQC for the Sediment IRM concurrently with the Freshwater Wetlands Site Remediation Exemption in August of 1995.

3.2.4 City of Cranston Soil Erosion Control Permit

The Sediment IRM required obtaining a Soil Erosion Plan Approval, a local permit, from the City of Cranston. Since the project involved the disturbance of soils along the bank of the river in the Production Area, a local soil erosion plan approval was required. This approval was obtained from the City Building Department. On April 27, 1995, the application was submitted to Mr. Alexander Pelagian, Director, Building Department. After submitting this application, Ciba contacted Mr. Pelegian on June 7, 1995 to determine if he had any questions or comments. He had none and stated that the permit had been approved without comment.

3.2.5 Industrial Wastewater Discharge Permit

Another local permit, an Industrial Wastewater Discharge Permit, was required by the City of Cranston POTW. This permit would allow the discharge of treated wastewater from the dewatering/stabilization of the sediment to the sewer.

Negotiation of the Industrial Wastewater Discharge Permit with the Cranston POTW was required because the Cranston POTW will not accept wastewater that may cause them to exceed any of their local, state, or federal permits. The Cranston POTW was concerned that Ciba's pretreated wastewater discharge might cause them to exceed their Rhode Island Pollutant Discharge Elimination System (RIPDES) Permit. The reasons for the concern were that the sediments contained PCBs and elevated levels of organic compounds.

Ciba provided the POTW with the design details of the temporary system that would be used to pretreat captured surface water before discharging it to the Cranston POTW. Sampling protocols and a monitoring schedule were worked out to satisfy the POTW's concerns. Ciba held a pre-application meeting with the POTW to facilitate the processing of the application. After submitting the application, Ciba kept in regular contact with the POTW in order to facilitate their review of the application. Conference calls were held to respond to the POTW's comments. On November 13, 1995, Permit No. 0329 was formally issued to Ciba. It was modified via a letter on November 21, 1995, to incorporate additional sample analysis.

3.3 MOBILIZATION AND SITE PREPARATION

Sevenson Environmental Services, Inc. (SES) mobilized at the Site on October 16, 1995 to perform the sediment removal and disposal. During the next two weeks, the Site was cleared of brush debris and processed gravel was laid down as a sub-base for the four major work areas: Temporary Wastewater Pretreatment Area, Sprung Structure Area, Temporary Staging Area, and

Decontamination Area, as shown on Figure 3-1. The sub-base protective layer for these areas was completed by placing sand, filter fabric, and 30 mil HDPE liner down over the soil. A layer of processed gravel was placed over the HDPE liner. Soil erosion and sediment control measures were established according to the City of Cranston Soil Erosion Control Permit requirements.

3.4 SILT CURTAIN INSTALLATION

In-river activities were started on October 31, 1995 with installation of the silt curtain. The basic purpose of silt curtain was to provide a barrier extending from the water surface to several feet below the surface. This barrier would prevent the turbid water near the surface, created by the driving of the sheet pile system, from spreading either by dispersion or current flow. The steel supports for the silt curtain and the temporary sheetpile cofferdam were driven from shore using a 115-ton truck-mounted crane and vibratory hammer. The hammer was fitted with biodegradable hydraulic fluid because of its use over the river. Care was taken to restrict the crane and other heavy equipment from coming within 15 feet of the existing bulkhead in order to minimize loading on the bulkhead.

The silt curtain was supported by 20-foot long AZ-13 sheetpile pairs driven at 25-foot intervals 5 to 10 feet beyond the intended sheetpile system area. A heavyweight turbidity curtain with polystyrene floats and galvanized chain for bottom ballast was then strung between the driven supports and connected to the west river edge bulkhead, as shown on Figure 3-2.

3.5 SHEET PILE INSTALLATION

Installation of the temporary sheetpile cofferdam started on November 7, 1995 and was completed on November 18, 1995. The main system consisted of 45-foot long type AZ-13 sheetpile with support piles welded to the sheets. Sheetpiles were driven to a plan elevation with tops at elevation 15.0 feet MSL. Sheetpiles along the northern quarter of the outer perimeter encountered refusal up to 8 feet above plan elevation. Sheetpile driving resistance was light to moderate, with the exception of the encountered refusal. Additional sheetpiling was driven around the RCRA containment area in order to isolate it from other areas of excavation, as shown in Figure 3-2.

3.6 TURBIDITY MONITORING

As detailed in the Operation Plan (Appendix D), turbidity was to be measured upstream and downstream of the sheet pile installation area. The upstream monitoring point was located on the Site walk bridge, and the downstream monitoring location was on the facility railroad bridge, as shown in Figure 3-1. Data loggers recorded readings every five minutes. River monitoring began prior to in-river activities to establish a baseline. Comparison of upstream versus downstream turbidity was used to indicate any increase in turbidity due to in-river activities.

Comparison of readings during installation of the sheet piles and during excavation activities indicated no significant difference between upstream and downstream turbidity. Turbidity Monitoring analysis is summarized in Section 4.1.

3.7 DEWATERING

After sheetpile installation was completed, dewatering of the RCRA containment area began on November 20, 1995. Captured surface water was discharged into the river within the silt screen using two 3-inch electric sump pumps and a 6-inch diesel pump. With the three pumps operating, the dewatering rate was estimated by SES at approximately 3,000 gallons per minute (gpm), based on pump capacities. Discharge of the surface water to the river continued until the water level within the sheetpile system was approximately 1 foot above the river bottom. Surface water discharged into the river appeared clean, and had no measurable impact on the downstream turbidity monitoring station.

Surface water from subsequent dewatering within the temporary sheetpile cofferdam was sent to the temporary wastewater pretreatment system. This dewatering was performed using one (or two as needed) 3-inch electric submersible sump pumps, operating at a rate of approximately 300 gpm. In general, the pumping rate required to maintain a dewatered condition within the temporary sheetpile cofferdam was less than 300 gpm, with only intermittent operation of the sump pumps required.

3.8 TEMPORARY WASTEWATER PRETREATMENT SYSTEM

A temporary modular wastewater pretreatment system was assembled on-site to treat water generated during dewatering, sediment leaching, and decontamination washdowns. The pretreatment system consisted of a 50,000 gallon equalization tank, an oil/water separator, a pair of sand filters for gross solids removal, a pair of cartridge filters to remove additional sediment fines, and a pair of carbon filters to remove organics (Figure 3-3). The pretreated effluent was discharged to the local POTW by a tie-in to the on-site sewer system. Flow to the POTW was recorded using a non-resettable flow meter which was routinely monitored by an employee of the POTW. Effluent discharged to the POTW was monitored for total toxic organics, PCBs, total chromium, total copper, total lead, total mercury, total nickel, total silver, total zinc, total cyanide, total oil and grease, pH, and temperature. A summary of the monitoring program and results are presented in Section 4-2.

The wastewater pretreatment system was started up on November 21, 1995 and operated on an intermittent basis. The sealable sheetpile was very effective in minimizing leakage into the temporary sheetpile cofferdam area. Leakage into this area was only 100-200 gpm which was easily managed by the 300 gpm submersible pumps. On December 16, 1995 pretreatment operations were terminated after all excavation activity had been completed and the final decontamination water was pretreated and discharged to the POTW. A total of 2,017,916 gallons

of water was treated during the operational period. Following the requirements of the POTW discharge permit, a total of five samples were collected over this period. No exceedences of permit conditions or wastewater discharge limitations occurred during the operation of the pretreatment system. The POTW Discharge Permit is included in Appendix C.

3.9 HAZARDOUS SEDIMENT HANDLING

Excavation of sediment from the RCRA containment area was initiated on November 21, 1995 (Figure 3-2). This and all subsequent excavation was performed using a 115-ton truck-mounted crane and attached clamshell bucket. Excavated sediment was placed in plastic-lined roll-off containers. As each roll-off was filled, it was moved to the staging area pad or placed within the Sprung Structure (mixing facility) for stabilization, as shown in Figure 3-1. The sediment was stabilized by adding approximately 10 percent (by weight) Portland cement and then mixing it in a roll-off with a backhoe. A total of seven (7) truckloads representing 159 stabilized tons of potentially hazardous sediment were removed from this containment area. This waste was transported to the Chemical Waste Management facility in Port Arthur, Texas for incineration as a hazardous waste as shown in Table 3-1.

3.10 NON-HAZARDOUS SEDIMENT HANDLING

Excavation of the non-hazardous sediment also commenced on November 21, 1995. Depth and horizontal location control was provided by an SES spotter who guided the crane operator in placing the clamshell bucket. Excavation proceeded in a steady and timely manner with no unusual circumstances or problems encountered. Excavation within the temporary sheetpile cofferdam was completed on December 5, 1995. Excavation was completed to a minimum bottom elevation of -3 feet mean sea level (MSL) in accordance with the performance specifications. Excavated sediment was placed in plastic-lined roll-off containers. As each roll-off was filled, it was moved to the staging area pad or placed within the Sprung Structure (mixing facility) for stabilization. The sediment was stabilized by adding approximately 10 percent (by weight) Portland cement and mixing it in the roll-off with a backhoe. In order to expedite sediment stabilization, a bermed mixing area was constructed on an HDPE liner within the Sprung Structure to allow mixing outside of the roll-off container. Mixing was performed until the sediment met the required paint filter and unconfined compressive strength tests performed by SES. After stabilization was achieved, the sediment was loaded-out and shipped. A total of 2,210 tons (93 truckloads) of stabilized sediment was shipped to the Chemical Waste Management's Model City Landfill located in New York State (Table 3-1).

An independent surveyor, Louis Federici & Associates, performed a survey of the excavation bottom elevation to confirm performance specifications. Original bottom contours and post-excavation contours are shown in Figures 3-4 and 3-5, respectively. Based on the survey data, a volume of 1,122 cubic yards of sediment was removed from within the sheetpile area, including the RCRA containment area.

3.11 POST-EXCAVATION SAMPLING

The Workplan specified that the objective of the Sediment IRM was to remove visually contaminated sediments from the Former Cofferdam Area. As such, no concentration based clean-up criteria was established, and no post-excavation sampling was planned. However, at the request of USEPA and RIDEM, the Workplan was modified in a letter dated November 7, 1995 to include one round of post-excavation sampling within the Former Cofferdam Area. One sample would be taken at the bottom of the RCRA containment area, and six additional samples would be taken from the non-hazardous excavation area (Figure 3-6). All samples were analyzed for PCBs, VOCs, and metals. In addition, two sediment samples were collected from location RIRMCF01. Sample RIRMCF01 was analyzed for PCBs, VOCs, and metals. Sample RIRMCF01b was analyzed for RCRA TCLP parameters. The results are summarized in Table 3-2.

Prior to excavation, the delineated RCRA containment area had been classified as hazardous due to elevated concentration of chlorobenzene (D021) which exceeded the TCLP regulatory limit of 100 mg/l. The post-excavation TCLP result for chlorobenzene was 4.8 mg/l, well below the regulatory limit. No other VOCs, SVOCs, pesticides or herbicides were detected in this sample. The metals barium, cadmium, lead were detected at 0.54 mg/l, 0.007 mg/l, 0.04 mg/l, respectively.

A review of the results for the six other post-excavation samples indicate that the concentration of major Site-related constituents varied significantly. Chlorobenzene ranged from < 1 to 320 mg/kg. Toluene detections ranged from 5 to 150 mg/kg. Methyl ethyl ketone (2-butanone) ranged from <20 to 26 mg/kg. All concentrations were reported as dry weight.

PCBs (1248, 1254, and 1260) were detected in these samples. PCB 1248 concentrations ranged from 0.24 to 62 mg/kg. PCB-1260 was detected in two samples and ranged from 0.2 to 7.90 mg/kg. PCB-1254 was detected once at <0.2 mg/kg.

All metals analyzed for were detected. Zinc appeared to have the highest concentrations ranging from 26.1 to 1,180 mg/kg.

3.12 BACKFILLING

A witness barrier consisting of a non-woven geofabric was placed over the excavation bottom within the temporary cofferdam area on December 6, 1995. The excavated cofferdam was backfilled with clean quarried sand from December 6, through December 11, 1995. The backfill certification is presented as Figure 3-7. About 1,850 tons of sand were placed within the cofferdam at approximately the original river bottom contours (shown in Figure 3-4). Final surveyed elevations are provided on Figure 3-8.

3.13 SHEET PILE REMOVAL

The removal of the sheetpile from the temporary cofferdam was initiated upon completion of the backfill placement and was completed on December 20, 1995. Sheetpiles along the west wall were cut approximately 1 foot above the waterline and driven to the river bottom elevation. This was done at the suggestion of URS Consultants, the designer of the sheetpile system, in order to stabilize and support the existing bulkhead. All other sheetpiles were removed. An additional 70 tons of sand backfill was placed over the driven sheetpiles along the west wall. The silt curtain was then removed and turbidity monitoring was discontinued. All in-river activities for the Sediment IRM were completed by December 20, 1995.

Sheetpiles were sold to Severson Inc for reuse. The silt curtain was disposed of at the Model City Landfill.

3.14 DEMOBILIZATION AND RESTORATION

Site and equipment demobilization activities began during the week of December 11, 1995. As specified in the Site Operations Plan (Appendix D), all sheetpiles, heavy equipment, vehicles, roll-off containers, pumps, hoses and tools which entered the exclusion zone were decontaminated prior to leaving the Site. Water generated during decontamination was pretreated prior to discharging it to the POTW. After decontamination was completed, the temporary wastewater pretreatment system was dismantled and samples from the sand filters and GAC filters were taken for TCLP analysis. Both samples were below TCLP regulatory limits.

Since large quantities of sediment were handled and transferred during the excavation and stabilization activities, releases of some contaminants may have occurred. To minimize the impact of potential releases to the environment, an HDPE liner had been placed within the work areas. Processed gravel was placed on the liner and used as a base. This gravel was sampled to insure that it was not impacted by site operations.

Separate soil composite samples were collected from the Decontamination Area, Sprung Structure Area, the Temporary Wastewater Pretreatment Area, and the Temporary Staging Area. The samples were analyzed for volatile organic compounds and PCBs. Results indicated that some soil within the Sprung Structure contained slightly elevated levels of chlorobenzene (6.8 mg/kg), PCBs (33 mg/kg), and toluene (0.9 mg/kg). The Decontamination Area, Temporary Wastewater Pretreatment Area, and the Temporary Staging Area contained only trace amounts of organic compounds. Since the processed gravel was to be left on-site and utilized for final grading, Ciba decided to remove an additional layer of soil from the Sprung Structure Area and dispose of it at a RCRA/TSCA landfill.

Equipment decommissioning and demobilization was completed on January 10, 1996. Due to excessive snow and extremely cold weather, the contractor was unable to completely remove the additional soils from the Sprung Structure Area or to remove the HDPE liner from the

Temporary Wastewater Pretreatment Area, Temporary Staging Area, or the Sprung Structure Area.

3.15 FINAL CLEANUP

Sevenson re-mobilized on-site on April 22, 1996, after the Spring thaw, for the final cleanup. Additional soils were removed from the Sprung Structure Area. These soils were transported off-site for disposal at the Chemical Waste Management's Model City Landfill located in New York State. The HDPE liners beneath the Sprung Structure Area, the Temporary Wastewater Pretreatment Area, and the Temporary Staging Area were also removed and sent to Chemical Waste Management's Model City Landfill. In all, three truckloads of soils and debris (approximately 54 cubic yards) were sent for disposal. A bulldozer was used to restore the Site to its original grade, thus completing the contractor's responsibilities.

**TABLE 3-1
MANIFEST LOG
Sediment IRM
Ciba-Geigy Site
Cranston, Rhode Island**

To Port Arthur, Texas (Sediment from RCRA Containment Area)			
DATE	MANIFEST #	ON SITE WEIGHT	WEIGHT at FACILITY
11/22	01080214	21.49T	22.68T
11/22	01080211	23.78T	23.81T
11/22	01080212	21.92T	21.53T
11/22	01080213	23.35T	22.86T
11/27	01080215	22.48T	22.62T
11/27	01080216	22.67T	22.52T
11/28	01080217	23.17T	23.11T
TOTAL TONNAGE =			159.13
To Model City, New York (Sediment from Main Containment Area)			
DATE	MANIFEST #	ON SITE WEIGHT	LANDFILL WEIGHT
11/30	NY7460019	23.57T	23.26T
11/30	NY7460028	23.36T	23.42T
11/30	NY7460037	22.33T	22.24T
11/30	NY7460046	24.77T	25.41T
12/1	NY7460055	22.77T	23.61T
12/1	NY7460064	25.30T	25.86T
12/1	NY7460082	21.28T	23.04T
12/1	NY7460091	23.45T	23.75T
12/1	NY7460109	22.30T	24.38T
12/1	NY7460118	22.83T	23.64T
12/1	NY7460127	24.37T	24.68T
12/1	NY7460136	23.09T	22.42T
12/1	NY7460145	23.71T	24.92T
12/1	NY7460154	25.30T	25.93T
12/1	NY7460163	24.22T	24.68T
12/1	NY7460172	24.58T	24.79T
12/1	NY7460181	22.09T	23.75T

DATE	MANIFEST #	ON SITE WEIGHT	LANDFILL WEIGHT
12/1	NY7460199	23.06T	23.03T
12/1	NY7460208	23.10T	25.00T
12/1	NY7460235	23.61	24.13T
12/1	NY7460244	22.70	23.35T
12/1	NY7460217	24.41	23.72T
12/5	NY7460226	21.62	21.44T
12/5	NY7460253	23.43	23.58T
12/5	NY7460262	24.02	23.93T
12/5	NY7460271	24.64	24.36T
12/5	NY7460289	22.95	23.91T
12/5	NY7460298	22.97	22.64T
12/5	NY7460307	23.98	24.13T
12/5	NY7460316	24.11	24.01T
12/5	NY7460325	23.10	23.27T
12/5	NY7460334	22.47	22.33T
12/5	NY7460343	24.45	24.16T
12/5	NY7460352	23.58	23.93T
12/5	NY7460361	24.05	25.04T
12/5	NY7460379	24.70	24.33T
12/5	NY7460388	23.79	23.92T
12/5	NY7460397	23.2	23.51T
12/5	NY7460415	23.85	23.42T
12/5	NY7460424	25.06	25.09T
12/7	NY7460433	22.83	22.40T
12/7	NY7460442	23.33	22.04T
12/7	NY7460451	23.32	22.30T
12/7	NY7460469	22.69	23.70T
12/7	NY7460478	23.13	23.37T
12/7	NY7460487	24.12	24.48T
12/7	NY7460496	22.79	24.31T
12/7	NY7460505	23.21	23.74T
12/7	NY7460514	25.04	24.79T
12/7	NY7460523	24.76	24.94T
12/7	NY7460532	24.26	24.19T
12/7	NY7460541	25.28	25.16T
12/7	NY7460559	25.61	25.32T
12/7	NY7460568	23.94	24.36T
12/7	NY7460577	25.11	24.67T

DATE	MANIFEST #	ON SITE WEIGHT	LANDFILL WEIGHT
12/7	NY7460586	24.69	24.30T
12/7	NY7460595	24.04	24.62T
12/7	NY7460604	23.26	23.94T
12/7	NY7460613	23.67	25.09T
12/7	NY7460622	22.52	22.92T
12/7	NY7460631	24.35	24.32T
12/11	NY7460649	21.72	23.00T
12/11	NY7460658	22.47	23.88T
12/11	NY7460667	22.90	24.73T
12/11	NY7460676	22.50	23.75T
12/11	NY7460685	22.62	24.50T
12/11	NY7460694	23.56	26.62T
12/11	NY7460703	22.73	24.16T
12/11	NY7460712	22.43	25.92T
12/11	NY7460721	24.01	25.31T
12/11	NY7460739	24.18	25.32T
12/11	NY7460748	22.8	24.18T
12/11	NY7460757	23.05	23.08T
12/11	NY7460766	23.41	24.05T
12/11	NY7460775	24.53	26.68T
12/11	NY7460784	23.08	24.13T
12/11	NY7460793	23.66	24.50T
12/14	NY7460802	21.13	21.35T
12/14	NY7460811	24.37	24.62T
12/14	NY7460829	19.72	20.09T
12/14	NY7460838	23.69	24.94T
12/14	NY7460847	24.02	24.64T
12/14	NY7460856	23.25	23.87T
12/14	NY7460865	22.52	21.92T
12/18	NY7460874	24.48	24.51T
12/18	NY7460883	22.85	23.05T
12/18	NY7460892	23.67	23.12T
12/18	NY7460901	22.88	22.30T

DATE	MANIFEST #	ON SITE WEIGHT	LANDFILL WEIGHT
1/4/96	NY7460919	-	22.06T
1/4/96	NY7460928	-	26.67T
1/4/96	NY7460937	-	23.97T
1/8/96	NY7460946	-	12.98T
1/8/96	NY7460955	-	15.84T
TOTAL TONNAGE =			2,210.71

TABLE 3-2
SUMMARY OF POST-EXCAVATION SAMPLING ANALYSES¹
Sediment IRM
Ciba-Geigy Site
Cranston, Rhode Island

DETECTED PARAMETER							
Total Analyses ³	Sample Number ²						
	RIRMCF01	RIRMCF02	RIRMCF03	RIRMCF04	RIRMCF05	RIRMCF06	RIRMCF07
Acetone, mg/kg dw ⁴				0.076		0.062	0.15
1,1-Dichloroethene, mg/kg dw	3.7						
2-Butanone, mg/kg dw		20			26		
Trichloroethene, mg/kg dw	1.7						
Benzene, mg/kg dw	2.2						
4-Methyl-2-pentanone, mg/kg dw							0.091
Toluene, mg/kg dw	4.6	11	150				
Chlorobenzene, mg/kg dw	16	49	320	0.0091	5		
Aroclor-1248, mg/kg dw	1.2	19	62	0.33	0.32	0.24	
Aroclor-1254, mg/kg dw						0.14	
Aroclor-1260, mg/kg dw		7.9					
Barium, mg/kg dw	20.8	17.3	35.9	12.6	18.3	13.7	9.5
Cadmium, mg/kg dw		0.97	1.6				
Copper, mg/kg dw	29.7	60.2	96	12.5	39.4	17.5	12
Lead, mg/kg dw	54	28.2	69.7	7.7	29.5	21.7	9.5
Mercury, mg/kg dw	0.1	0.06	0.47	0.02	0.05	0.04	
Nickel, mg/kg dw	6.4	9	15.4		11.5	5.1	8.5
Vanadium, mg/kg dw	8.8	5.1	9.2	6.3	9.2	3.2	11.2
Zinc, mg/kg dw	111	348	1180	32.7	109	63.1	26.1
TCLP Analyses - RCRA Containment Area							
	RIRMCF01B						
Chlorobenzene, mg/l ⁵	4.87						
Barium, mg/l	0.54						
Cadmium, mg/l	0.007						
Lead, mg/l	0.004						

Notes:

1. Only detected parameters are reported
2. Sample designations refer to locations on Figure 3-6
3. Analysis of total sediment sample
4. Milligrams per kilogram on dry weight basis
5. Milligrams per liter

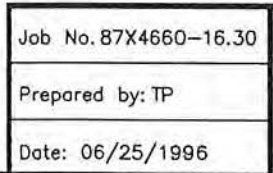
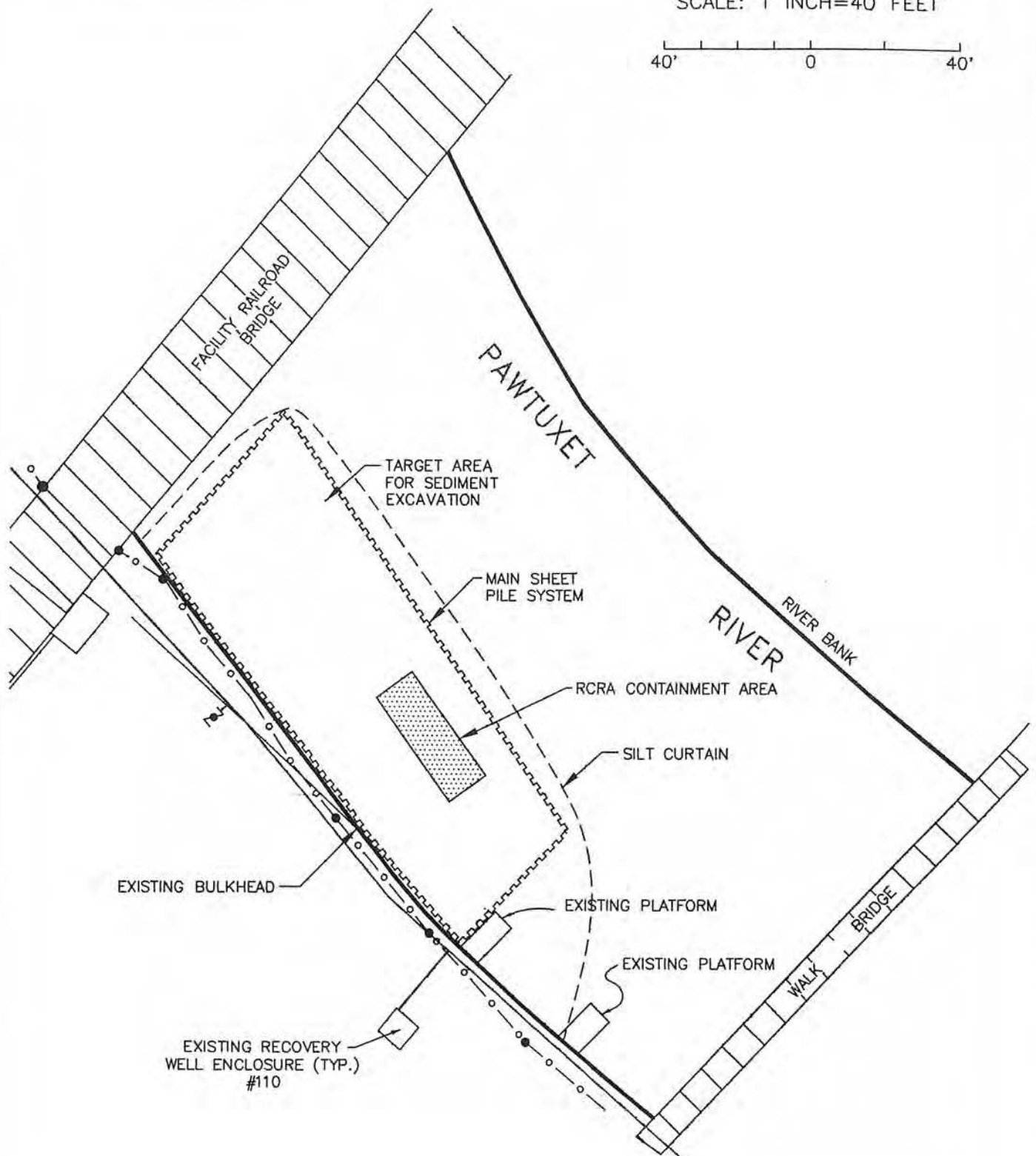


FIGURE 3-1



SCALE: 1 INCH=40 FEET

40' 0 40'



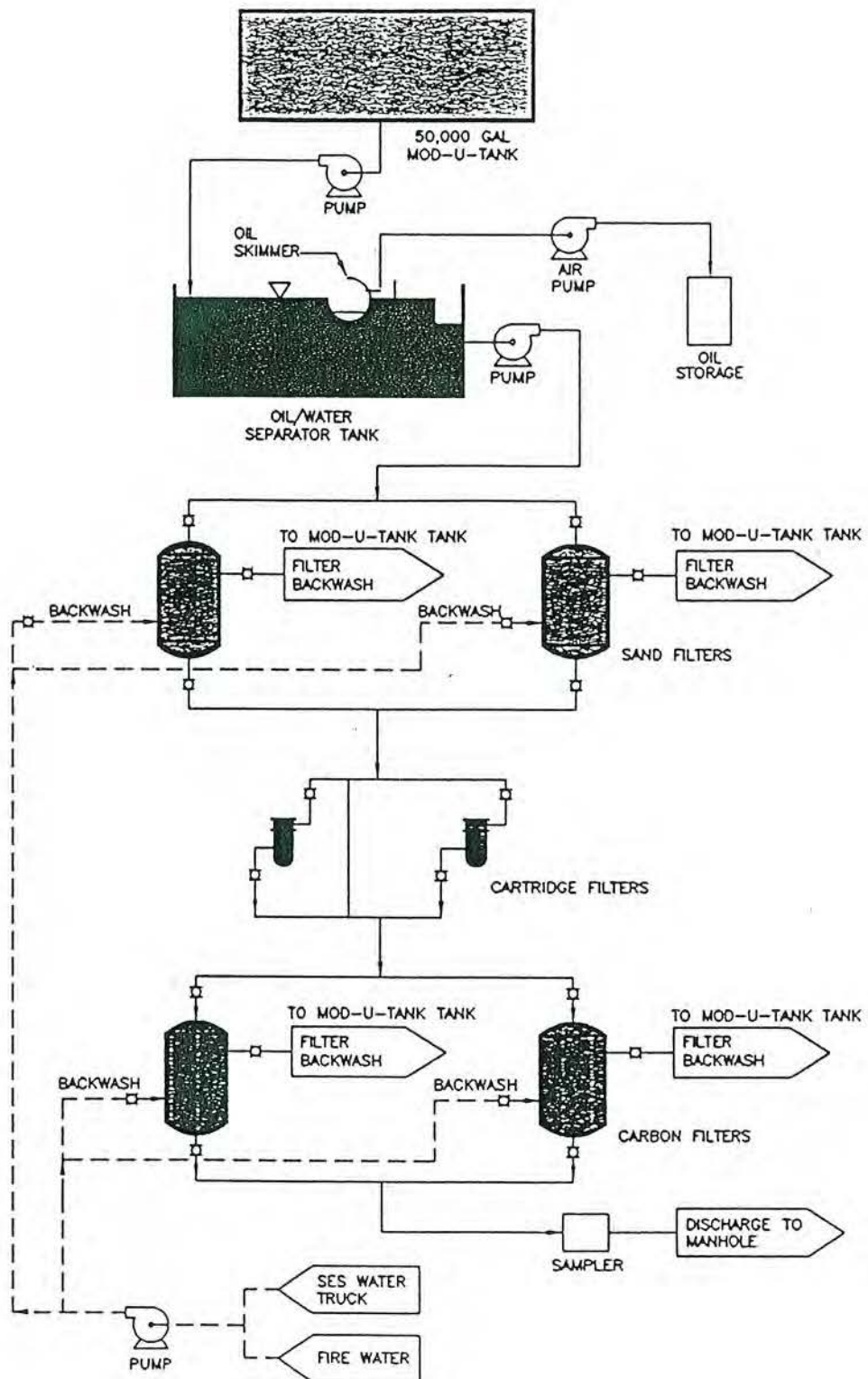
Job No. 87X4660-16.30

Prepared by: TP

Date: 06/26/1996

 RCRA CONTAINMENT AREA LOCATION
 COFFERDAM IRM
 CIBA-GEIGY SITE
 CRANSTON, RHODE ISLAND

FIGURE 3-2



Job No. 86X4660-16.30

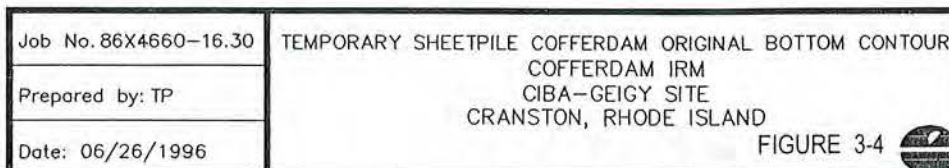
Prepared by: TP

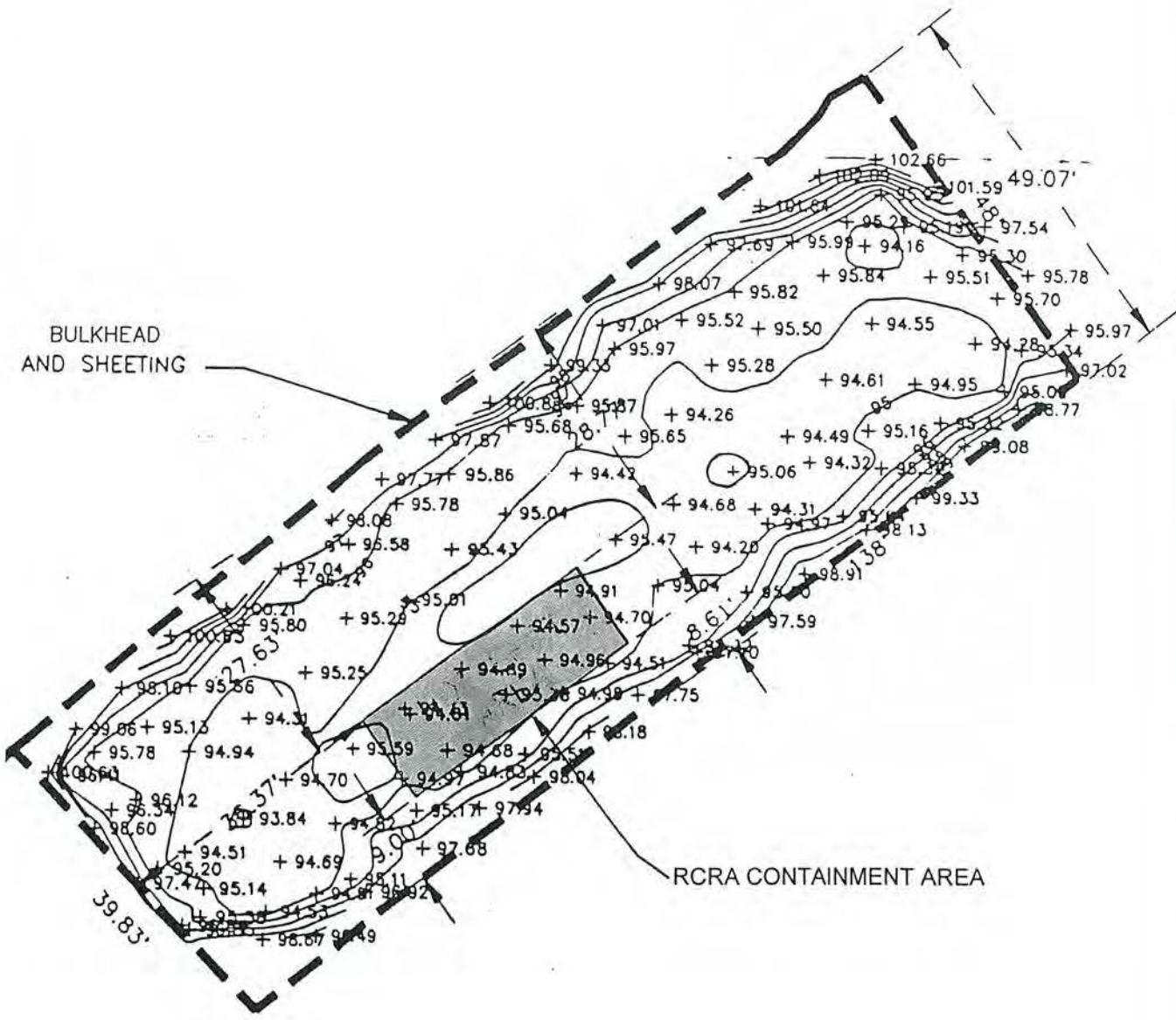
Date: 06/26/1996

WASTE WATER PRE-TREATMENT PROCESS FLOW DIAGRAM
 COFFERDAM IRM
 CIBA-GEIGY SITE
 CRANSTON, RHODE ISLAND

FIGURE 3-3







I:\DRAFT\7660\76601009

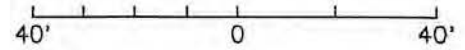
Job No. 86X4660-16.30	TEMPORARY SHEETPILE COFFERDAM POST-EXCAVATION CONTOUR COFFERDAM IRM CIBA-GEIGY SITE CRANSTON, RHODE ISLAND
Prepared by: TP	
Date: 06/26/1996	

FIGURE 3-5



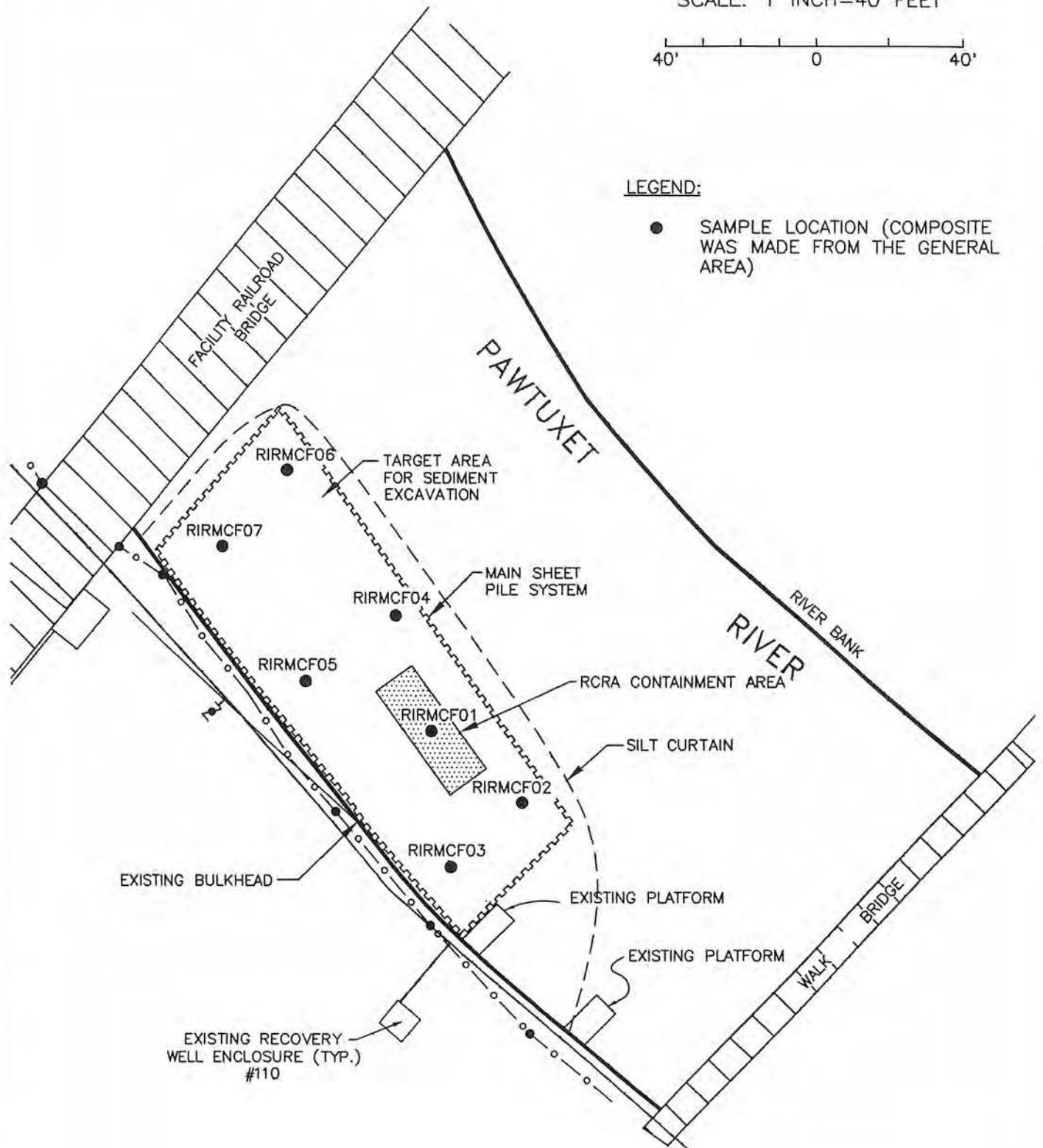


SCALE: 1 INCH=40 FEET



LEGEND:

- SAMPLE LOCATION (COMPOSITE WAS MADE FROM THE GENERAL AREA)



I:\DRAFT\7660\76601010

Job No. 87X4660-16.30
Prepared by: TP
Date: 06/26/1996

POST-EXCAVATION SAMPLING LOCATION PLAN
 COFFERDAM IRM
 CIBA-GEIGY SITE
 CRANSTON, RHODE ISLAND

FIGURE 3-6





RIVER SAND & GRAVEL COMPANY, INC.

Mailing Address | P. O. Box 2190 - Darlington Station
Pawtucket, Rhode Island 02861

November 30, 1995

Sevenson Enviromental Co.
P O Box 3596
Cranston, Rhode Island 02910

Re: Ciba-Geigy Chemical Co.
Mill Street
Cranston, Rhode Island 02910

Att: Mr. Alan Elia

Dear Mr. Elia:

The sand that we supplied to the above subject project meets the STATE OF RHODE ISLAND specifications for washed, clean, screened concrete sand with a Finess Modulas of 2.80⁺.

To the best of our knowledge this was virgin material and the land was not used for industrial purposes.

Sincerely

RIVER SAND & GRAVEL CO.

Angelo Saccoccia
Vice Pres.

PLANT LOCATIONS
Frenchtown Road, East Greenwich, R.I.
Route 112, Richmond, R.I.
School St., Pawtucket, R.I.

MAIN OFFICE
School Street
Pawtucket, R.I.
(401) 727-0400

SALES and DISPATCH OFFICE
Frenchtown Road
East Greenwich, R.I.
(401) 885-4010

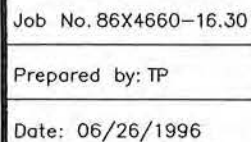
FIGURE 3-8 

PHOTO LOG
Sediment IRM

No.	DATE	DESCRIPTION
1	10/30/95	Overview of mobilization/site preparation activities.
2	10/30/95	Overview of mobilization/site preparation activities.
3	10/30/95	Upstream turbidity monitoring station.
4	10/30/95	Downstream turbidity monitoring station.
5	10/31/95	Start of in-river activity, silt curtain installation.
6	---	Silt curtain installed.
7	11/7/95	Sheetpiling around RCRA containment area.
8	---	Start of cofferdam sheetpiling.
9	11/20/95	Completed cofferdam and initial dewatering.
10	11/21/95	Dewatered cofferdam, start of RCRA containment area excavation.
11	07/13/95	Excavated sediment placed in rolloffs.
12	11/28/95	Sediment/cement mixing in rolloffs.
13	11/22/95	Site overview and stabilized material shipment.
14	12/1/95	Sediment mixing and shipment.
15	11/29/95	Post-excavation sampling.
16	11/29/95	Preparation of post-excavation sample for analysis.
17	12/5/95	Completed excavation and post-excavation sampling.
18	12/5/96	Post-excavation sample preparation.
19	11/9/95	Preparation of water treatment mod-u-tank.
20	11/21/95	Water treatment system.
21	12/5/95	Excavation bottom.

No.	DATE	DESCRIPTION
22	12/6/95	Witness layer and start of backfilling.
23	12/8/95	Clean sand backfill.
24	12/8/95	Clean sand backfill.
25	12/11/95	Start of sheetpile removal.
26	12/14/95	Continued sheetpile removal.
27	12/16/95	Cutting/driving sheetpile along bulkhead to river bottom.
28	12/20/95	Sheetpile cutting/driving completed along bulkhead.
29	12/21/95	Removing silt curtain.
30	12/21/95	End of in-river activity.
31	---	Site restored to original grade.
32	---	Site restored to original grade.

4.1 TURBIDITY

During the Sediment IRM activities, river water was monitored for turbidity as an indicator of the effectiveness of the sediment containment controls (i.e. silt curtain and sealable sheet piling). Turbidity was measured upstream at the footbridge and downstream at the facility railroad bridge, as shown previously on Figure 3-1.

The monitoring instrument (Yellow Springs YS13800) consisted of a data logger box attached by a logger cable to a sonde containing a turbidity probe. Turbidity was measured in Nephelometric Turbidity Units (NTUs) with an accuracy of ± 2 NTU's.

To establish a baseline, turbidity monitoring began prior to commencing in-river activities. Once the in-river activities began, monitoring was continuous. The probes were located on the upstream and downstream bridges in the river flow potentially affected by Sediment IRM activities. The probes were lowered to a depth of 2-3 feet below the surface of the river. The instruments were set to log turbidity at five minute intervals throughout the day. The average daily turbidity readings measured at the upstream and downstream locations were essentially the same during the in-river activities. Average readings are shown in Figure 4-1. Most measurements were well below 10 NTUs, the guidance level proposed for this investigation.

4.2 WASTEWATER PRETREATMENT

During the Sediment IRM, the temporary wastewater pretreatment system was started on November 21, 1995 and operated intermittently through December 16, 1995. A total of 2,017,916 gallons of water was pretreated during the period of operation. As required by the City of Cranston POTW, five samples were collected and analyzed for parameters listed in the permit. Permit conditions or wastewater discharge limitations were met during the operation of the pretreatment system. The sampling results are summarized in Table 4-1.

4.3 AIR

Both real-time and integrated air monitoring were conducted during this IRM. The monitoring levels were compared to the OSHA developed permissible exposure limits (PELs) for each of the parameters. The real-time program included monitoring of total organic vapors, respirable particulates, confined-space-entry-percent oxygen, and percent lower explosive limit (LEL). Integrated monitoring consisted of a total hydrocarbon scan with identification and quantification of 16 common organic compounds with a quantification of both polar and non-polar compounds and total particulates.

The following is a summary of the real-time air monitoring results:

- The highest concentrations of volatile organic compounds were detected in the Sprung Structure during stabilization mixing activities. Based on these measurements, personnel were in Level C protection.
- The highest respirable particulate concentration was 57 ug/m^3 . Based on the OSHA PEL for respirable particulate of $5,000 \text{ ug/m}^3$, this level is not considered to be significant.
- All conditions were normal (0% LEL and 20.8% O_2) during the confined-space entry.

The following is a summary of the integrated monitoring results:

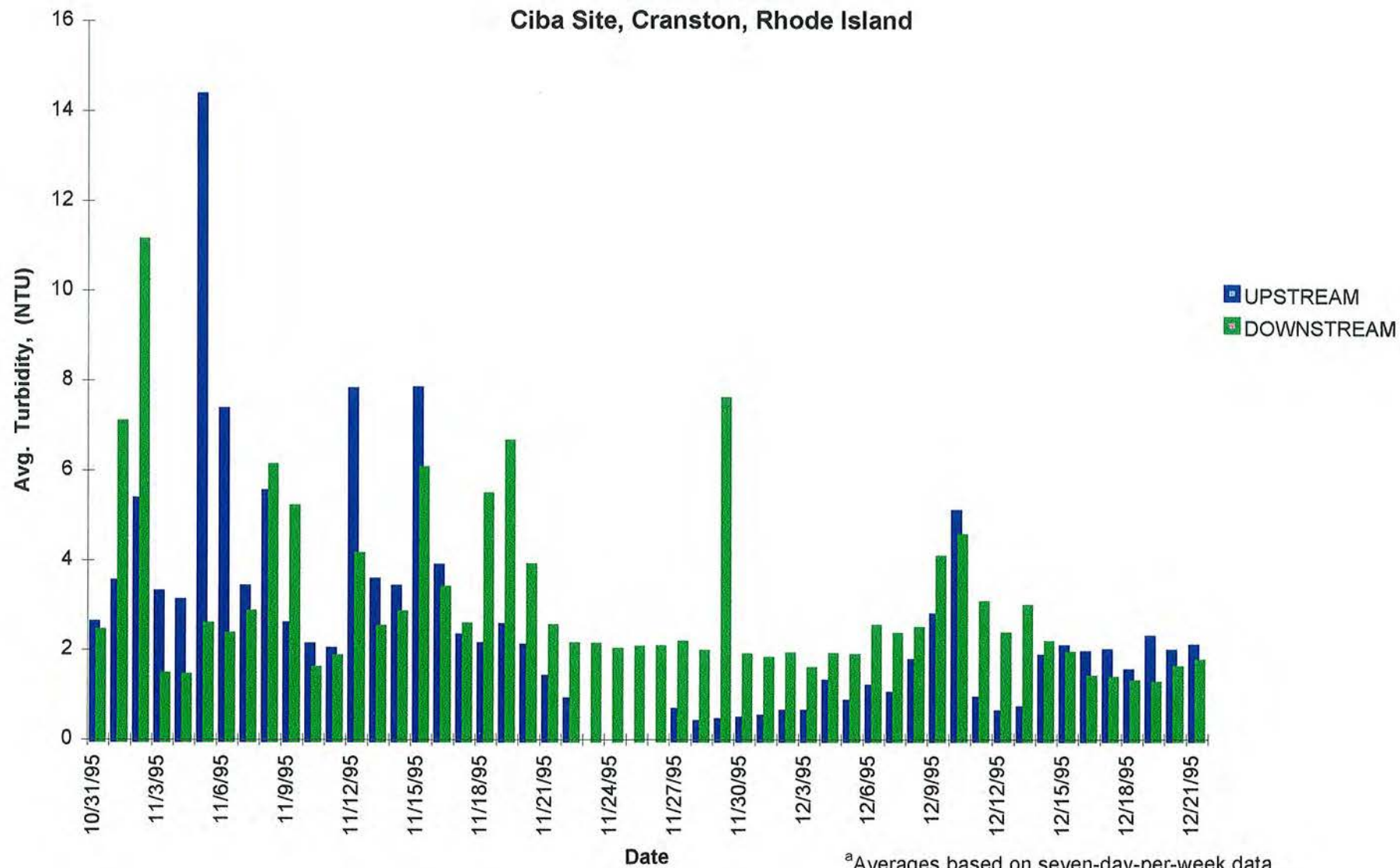
- On October 30 and 31, 1995, background air samples were measured along the Site perimeter. No volatile organic compounds were detected; total particulate matter concentrations were less than 140 ug/l . Based on the OSHA PELs for total particulate matter of $15,000 \text{ ug/l}$, this level is not considered to be significant.
- Air sampled from the crane operator's breathing space indicated that his exposure was 0.059 ppm chlorobenzene and 0.024 ppm toluene. These exposures were well below the current OSHA PELs of 75 ppm for chlorobenzene and 200 ppm for toluene.
- Chlorobenzene in very low concentrations (0.020 and 0.039 ppm) was detected at two downwind perimeter monitoring stations (shown in Figure 4-2 and 4-3). This detections were recorded on November 30 and December 7, 1995. Also on December 7, 1995, toluene was detected in one of these samples at a concentration of 0.045 ppm. As discussed above, these concentrations are well below the OSHA PELs for these compounds.

It can be concluded that work activities performed during the Sediment IRM had no significant effect on ambient air quality. No odors were reported off-site. When elevated concentrations of organic vapors were encountered within the Sprung Structure during solidification activities, the employee protection level was upgraded to Level C. Neither the employees nor the general public were adversely affected by the Site operations.

TABLE 4-1
DISCHARGE MONITORING ANALYSIS SUMMARY
Sediment IRM
Ciba-Geigy Site
Cranston, Rhode Island

Monitoring Parameter	PERMIT-LIMIT	SAMPLE DATE				
		11/21/95	11/29/95	12/2/95	12/5/95	12/16/95
	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Total Toxic Organics	2.13	0.001	0.001	0.001	0.001	0.001
Total Cyanide	0.3	<0.01	<0.01	<0.01	<0.01	<0.01
Total Petroleum Hydrocarbons	NA	<0.5	<0.5	<0.5	<0.5	<0.5
Oil & Grease	25	<0.5	<0.5	0.6	<0.05	<0.05
Total Cadmium	0.04	<0.005	<0.005	<0.005	<0.005	<0.005
Total Chromium	0.4	<0.03	<0.03	<0.03	<0.03	<0.03
Total Copper	1	<0.05	<0.05	<0.05	<0.05	<0.05
Total Lead	0.3	<0.04	<0.04	<0.04	<0.04	<0.04
Total Mercury	<0.005	<0.0005	<0.02	<0.02	<0.02	<0.02
Total Nickel	0.7	<0.02	<0.02	<0.02	<0.02	0.07
Total Silver	0.1	<0.02	<0.02	<0.02	<0.02	<0.02
Total Zinc	1	<0.02	0.46	0.2	0.16	0.55

Figure 4-1
Average Daily Turbidity^a
Pawtuxet River
Ciba Site, Cranston, Rhode Island



^aAverages based on seven-day-per-week data

SCALE IN FEET

60' 0 60'

R.I. STATE PLANE
COORDINATE SYSTEM

EXISTING STEEL
RETAINING WALL

FACILITY RAILROAD
BRIDGE

WARWICK
AREA

SHEET PILE
SYSTEM

PAWTUXET

RIVER BANK

SITE
TRAILERS

TEMPORARY WASTEWATER
PRE-TREATMENT AREA

EXISTING BULKHEAD

EXISTING PLATFORM

WALK
BRIDGE

RIVER

FLOW

PERMANENT FENCE
INSTALLED BY CIBA

UP1

DECON
AREA

SHOWER
TRAILER

WEIGHT
TRAILER

P-55

WIND DIRECTION

WEIGHT
SCALE

SAFETY
FENCE

SPRUNG
STRUCTURE AREA

SAFETY
FENCE

TEMPORARY
STAGING AREA

RIVER'S
EDGE

DWN1

DWN2

MW-31D

SW-120

P-31D

P-33D

P-33S

RC-2

PW-120

P-2D

P-2S

MW-120

MW-31D

SW-120

P-31D

P-33D

P-33S

RC-2

PW-120

P-2D

P-2S

MW-120

MW-31D

SW-120

P-31D

P-33D

P-33S

RC-2

PW-120

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SW-120

P-31D

P-33D

P-33S

RC-2

PW-120

P-2D

P-2S

MW-120

MW-31D

SW-120

P-31D

P-33D

P-33S

RC-2

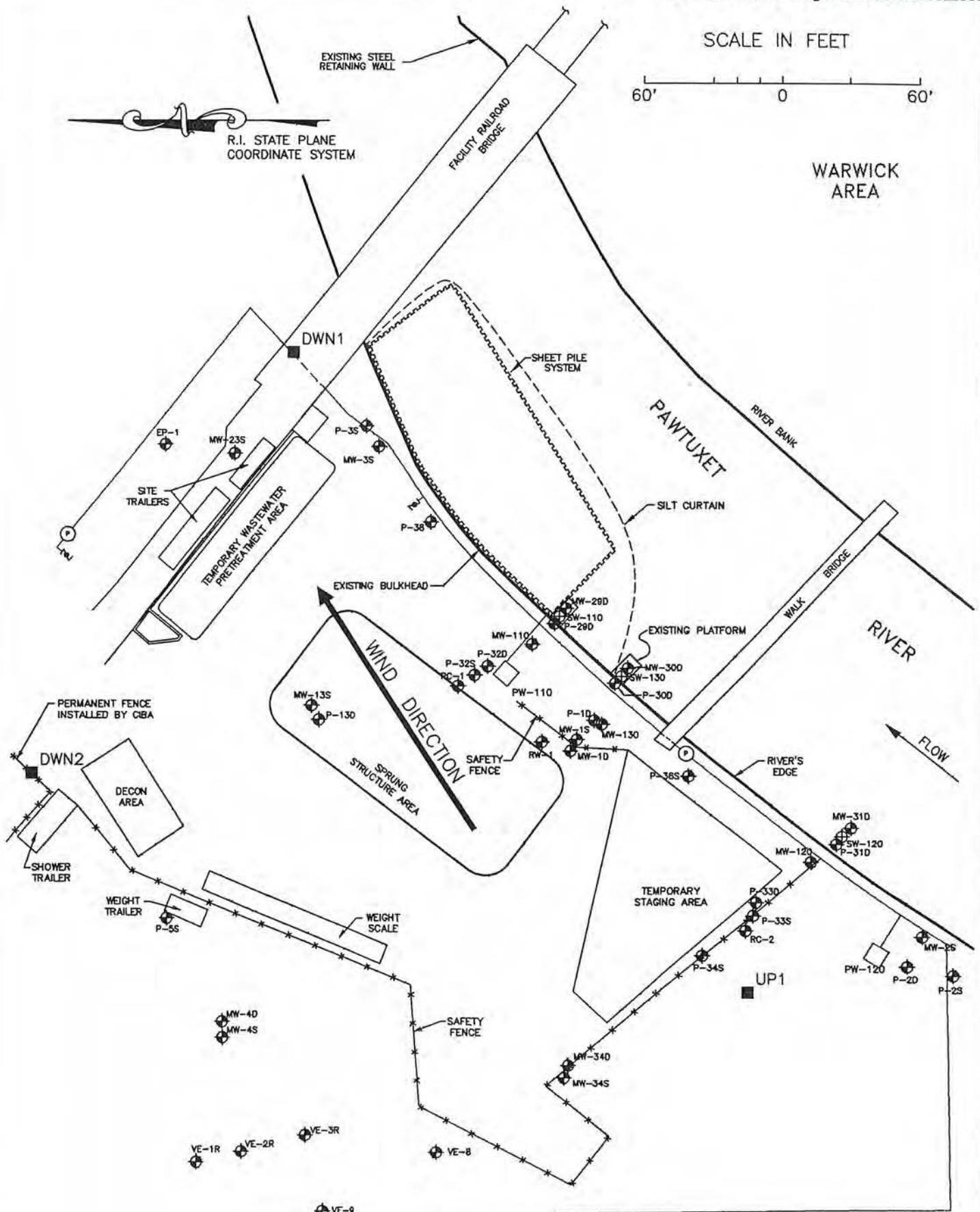
PW-120

P-2D

SCALE IN FEET

60' 0 60'

WARWICK AREA



Job No. 87X4660-16.30

Prepared by: TP

Date: 06/26/1996

AIR MONITORING LOCATIONS DECEMBER 7, 1995
COFFERDAM IRM
CIBA-GEIGY SITE
CRANSTON, RHODE ISLAND

FIGURE 4-3

5.1 SUMMARY

Ciba conducted a Sediment IRM at their former facility in Cranston, Rhode Island during the period October 12, 1995 through January 10, 1996. The Sediment IRM was performed voluntarily; it was part of the overall IRM program that Ciba is implementing at this Site. The work performed during the Sediment IRM was conducted according to the procedures presented in the Conceptual Design Work Plan, Cranston Site, Cofferdam Interim Remedial Measure (Workplan) that was submitted to USEPA, RIDEM and the USACOE in May 1995. Comments generated by these agencies were addressed during the implementation of this Sediment IRM. When completed, the Sediment IRM achieved its primary objective of excavating visually contaminated river sediment from the Former Cofferdam Area.

Over 2,225 tons of contaminated sediment were excavated from the Pawtuxet River and replaced with clean sand. The Sediment IRM was completed with no construction-related impacts to the Pawtuxet River. In-river turbidity measurements conducted during the IRM showed no measurable effects on river water quality. Air monitoring conducted during the IRM indicated no quantifiable releases of constituents to the surrounding area. Surface water generated during dewatering was pretreated and discharged to the City of Cranston POTW. Sampling of the effluent from the temporary pretreatment facility was performed periodically. All sample results were below the permitted discharge limits required by the Cranston POTW.

The cost of the sediment removal and disposal, including planning and permits, was \$1.678 million.

Post-excavation sampling of sediment was required by RIDEM. Sediment was sampled from the RCRA containment area and from six other locations within the Former Cofferdam Area. Several constituents (chlorobenzene, PCBs, and toluene) were detected in these samples at varying concentrations. Based on the results of the TCLP analysis, sediment sampled from the RCRA containment area was non-hazardous.

5.2 CONCLUSIONS

After implementing this IRM, the sediment quality of the river within the Upper Facility Reach improved significantly. The modeling investigation and the ecological risk assessment indicated that long lasting, significant improvements would be achieved within the Former Cofferdam Area. Currently, sediment within the Upper Facility Reach is less toxic than sediment within the other reaches investigated during the RCRA Facility Investigation. After completing the Sediment IRM, the residual toxicity is dominated by compounds not related to the Site, mostly PAHs and metals (primarily thallium). This indicates that further remediation of sediment for Site-related compounds would produce no significant long term benefits.

Specific benefits of performing the Sediment IRM are summarized here.

- *Excavation of sediment within the former Cofferdam Area produced significant, long-term reductions in contaminant concentrations.* During the modeling investigation of the Pawtuxet River, concentrations of selected compounds (PCBs, Tinuvin 328, and zinc) were projected within the Upper Facility Reach over time. A summary of the initial (pre-excavation concentrations) and final results (concentrations expected after 10.6 years) is shown in Table 5-1. More than ten years after the excavation was completed, the model predicts that contaminant concentrations for these selected compounds will remain well below the initial concentrations. The projected concentrations of PCBs and zinc are contributed by upstream sources not related to the Site.
- *The ecological toxicity index (ETI) for benthic invertebrates within the Upper Facility Reach was reduced significantly.* After completing the Sediment IRM, the ETI estimated for benthic invertebrates was reduced by 60 percent (from 74 to 30). Chloroaniline, one compound which accounted for a significant portion of the risk, was virtually eliminated within the Upper Facility Reach. Although an ETI exceeding 10 indicates a probable adverse impact to the ecology, all four river reaches exceeded this criteria. After sediment in former Cofferdam Area was excavated, the current ETI for benthic invertebrates in the Upper Facility Reach is well below the ETIs estimated for the other river reaches (Table 5-2).
- *The ETI estimated for raccoons in the Upper Facility Reach was reduced by 96 percent (from 55 to 2).* This dramatic decrease in the ETI was mainly attributed to the elimination of PCBs within the area excavated. The current ETI for raccoons in the Upper Facility Reach is also below the ETIs estimated for the other river reaches (Table 5-2).

The information supporting these conclusions are presented in the RCRA Facility Investigation Report Pawtuxet River submitted to USEPA in March 1996.

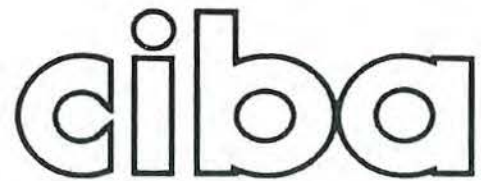
TABLE 5-1
EFFECT OF REMEDIAL ACTIONS ON CONTAMINANT CONCENTRATIONS
IN SEDIMENTS ADJACENT TO THE CIBA PRODUCTION AREA
OVER 10.6 YEAR PROJECTION
Sediment IRM
Ciba-Geigy Site
Cranston, Rhode Island

CHEMICAL	EFFECTIVE ACTION	CONCENTRATION AT PRODUCTION AREA (mg/kg)	
		Initial	Final
PCBs	Excavation	66	1.6
Tinuvin 328	Excavation	640	0.3
Zinc	Excavation	2800	330

TABLE 5-2
SUMMARY OF ESTIMATED RISKS*
Sediment IRM
Ciba-Geigy Site
Cranston, Rhode Island

TOXICITY QUOTIENTS FOR BENTHIC INVERTEBRATES					
Chemical Class	Upstream	Upper Facility		Lower Facility	Downstream
		Before Excavation	After Excavation		
Metals	2.6	4.4	2.4	4.5	4.5
PAHs	77.1	33.6	22.9	103.0	79.6
PCBs/Dioxins/Furans	0.0	4.2	0.0	0.2	0.1
Organochlorine Pesticides	7.3	6.4	2.6	36.6	10.2
Organophosphorus Pesticides	0.0	0.0	0.0	26.2	0.0
VOCs	0.4	6.8	0.2	0.0	0.1
Phenols	4.2	4.5	1.0	1.6	78.2
4-Chloroaniline	0.3	12.9	0.0	0.0	0.0
Other	0.1	0.7	0.6	0.3	0.2
Ecological Toxicity Index	92	74	30	173	173
TOXICITY QUOTIENTS FOR FISH					
Chemical Class	Upstream	Upper Facility		Lower Facility	Downstream
		Before Excavation	After Excavation		
Metals	10.1	5.9	5.9	7.7	7.0
Other	0.0	0.0	0.0	0.5	0.3
Ecological Toxicity Index	10	6	6	8	7
TOXICITY QUOTIENTS FOR RACON					
Chemical Class	Upstream	Upper Facility		Lower Facility	Downstream
		Before Excavation	After Excavation		
Metals	3.6	2.7	1.7	6.3	4.2
PCBs/Dioxins/Furans	0.0	51.4	0.0	1.8	0.9
Other	0.4	0.6	0.1	0.7	0.8
Ecological Toxicity Index	4	55	2	9	6
TOXICITY QUOTIENTS FOR HERON					
Chemical Class	River-Wide Total				
	Before Excavation		After Excavation		
Metals	7.3		7.2		
PCB/Dioxins/Furans	1.1		0.2		
Organochlorine Pesticides	3.2		3.1		
Other	1.2		1.2		
Ecological Toxicity Index	13		12		

* Includes the chemical classes accounting for >90% of the Ecological Toxicity Index of one or more river reaches.



**CONCEPTUAL DESIGN WORKPLAN
CRANSTON SITE
COFFERDAM INTERIM REMEDIAL MEASURE**

PREPARED BY:

**CIBA GEIGY CORPORATION
REGIONAL REMEDIATION TEAM
TOMS RIVER, NJ**

WOODWARD CLYDE CONSULTANTS

MAY 2, 1995

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1.1 Overview

This document presents a Work Plan for performance of an Interim Remedial Measure (IRM) related to sediment in the Pawtuxet River, adjacent to Ciba's former manufacturing facility in Cranston, Rhode Island. The intent of this document is to provide a comprehensive description of the intended project and ancillary activities. These descriptions are conceptual in nature, and are preliminary to more detailed engineering design documents and plans to be developed as part of a performance bidding procedure.

1.1.1 Site Description

The Ciba Cranston Site is located near Cranston, Rhode Island in the mid-eastern portion of the state. The 31 acre Site is adjacent to the Pawtuxet River that drains through Pawtuxet Cove into the Providence River and ultimately into the Narraganset Bay. The Site borders the northern and southern boundaries of the River between Interstate 95 and Alternate Route 1 (Figure 1.1). Approximately 13 acres of the Site are located north of the Pawtuxet River in Cranston and about 18 acres lie south of the River in Warwick. The Site is located in both Providence and Kent counties.

The Site is bordered to the north and south by residential areas, to the east by commercial areas and to the west by both open space areas and a mixed industrial area (Figure 1.2). The Site elevation ranges from about 10 to 25 feet above mean sea level.

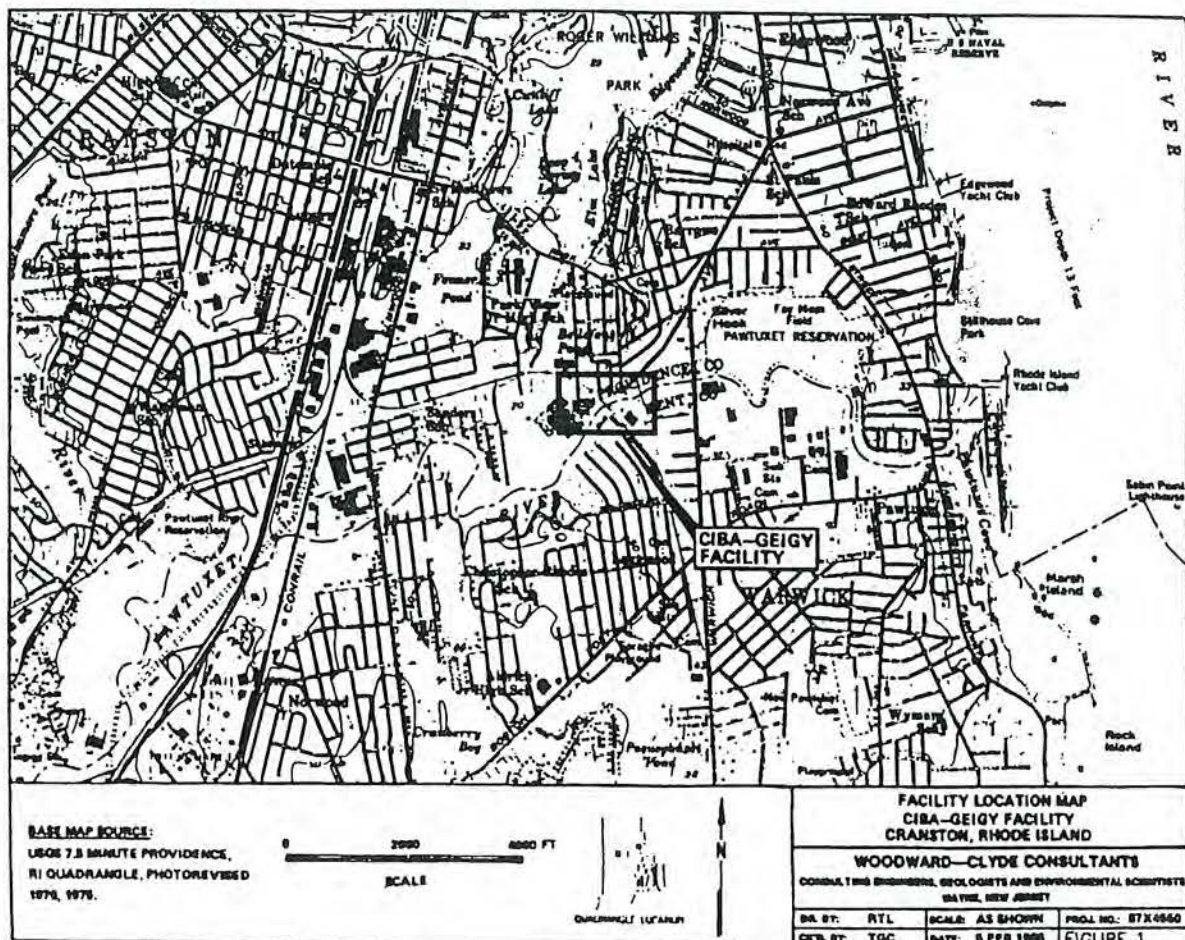
1.1.2 Pawtuxet River Description

The Pawtuxet River flows from west to east through the Site. The Pawtuxet River drains about 230 square miles of mixed industrial and urban land. Flow in the River is regulated by reservoirs upstream. The River is classified as "Class D" by Rhode Island Department of Environmental Management (RIDEM) from the Cranston Sewage Treatment Plant, to downstream of the Site. Class D waters are suitable for migration of fish and have good aesthetic value, but should not be used for drinking or contact recreation.

The average daily flow in the River is about 340 cfs. Highest flows occur in April; lowest flows occur in August. The River fluctuates 5 feet in stage height, based on previous data.

In the 4.5 mile section of the River from the Cranston gauge to Pawtuxet Cove Dam, the River varies from about 60 to 200 feet wide, with mid-channel depths of 3 to 14 feet. Sediment thickness ranges from <0.5 to 4 feet thick, based on a manual probing study of the sediment. Depositional zones, or areas where sediments are thicker, tend to occur on the inside bends of the River and just downstream of large pools. Sediment within these depositional zones is typically characterized by high total organic carbon content (TOC) and higher percent fines.

FIGURE 1.1 USGS TOPOGRAPHIC LOCATION MAP OF SITE



1.2 Integration with Other IRMs

Ciba intends to perform two other IRMs coincidentally at the Site. PCB contaminated soils will be removed from the Production Area and the Warwick property across the River, and a groundwater extraction and soil vapor extraction system will be installed for purposes of capture and stabilization of groundwater contamination, both to be implemented during the 1995 calendar year. All activities will be coordinated appropriately to optimize activities at the Site. Following is the anticipated schedule for these efforts:

<u>REMEDIAL ACTIVITY</u>	<u>DURATION</u>
Removal of PCB-Contaminated Soils From Site	5/22 - 6/30/95
Construction of Stabilization Systems in Production Area & Building 15	6/1 - 9/29/95
Remove Former Cofferdam Sediments	10/2 - 12/14/95

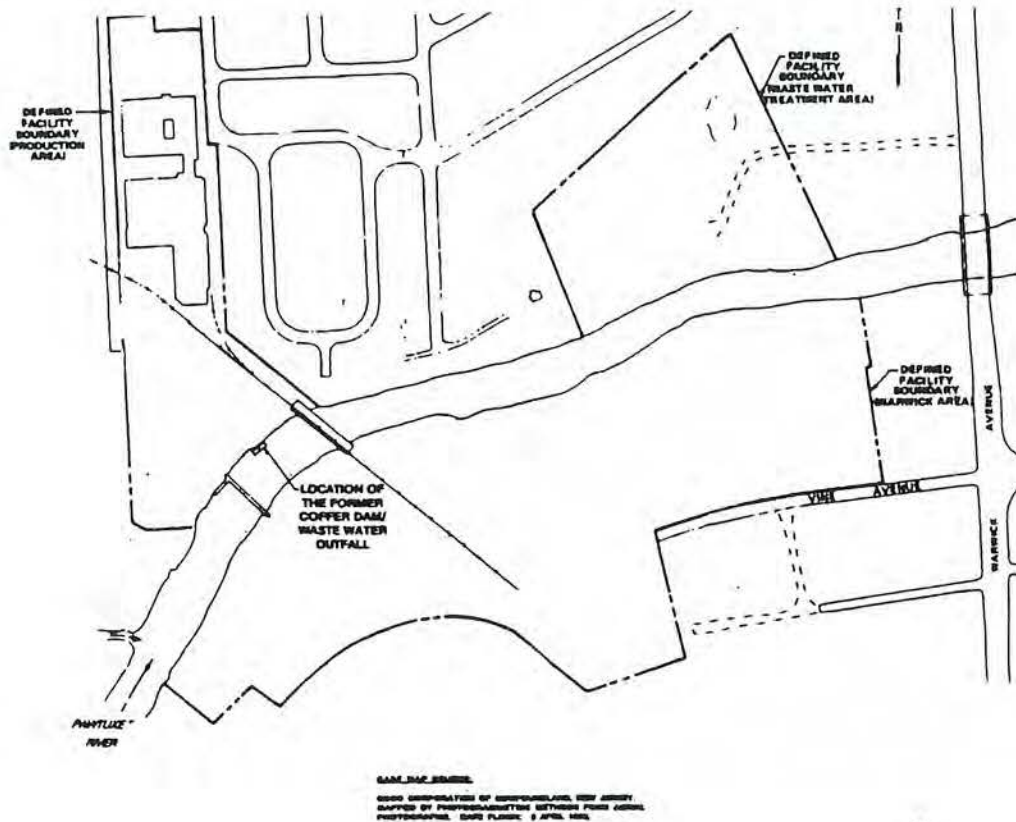
1.3 Objectives of IRM

The primary objective of the Cofferdam IRM at the Ciba Cranston Site is to remove visually contaminated River sediments in the approximate location of the former Cofferdam area, which is located along the Pawtuxet River on the production-side of the Site between the railroad bridge and the foot bridge which transverse the River (Figure 1.2). Ciba intends to perform the IRM on a voluntary basis to expedite the remediation of the Site. Visual removal is possible due to the fact that the contaminated materials are of a different color than that of the surrounding sediments based on sediment probing performed in 1994.

The horizontal and lateral extent of visually contaminated sediment at the former Cofferdam area was delineated as part of the ongoing RCRA Facility investigation (RFI) at the Site. Now that the delineation is complete, the Cofferdam IRM is being performed to remove this material promptly and coordination with the other IRMs prior to completing the CMS in 1996. The CMS will be used to determine the efficacy of the Cofferdam IRM consistent with the long-term solutions for the Cranston Site. Ciba understands that the remedy proposed in this conceptual workplan is interim and cannot be approved as the final remedy until the Corrective

Measures Study (CMS) for the River is completed. Ciba intends to implement the proposed Cofferdam IRM in order to compliment the River CMS development and assist in the CMS approval process.

FIGURE 1.2 SITE LAYOUT



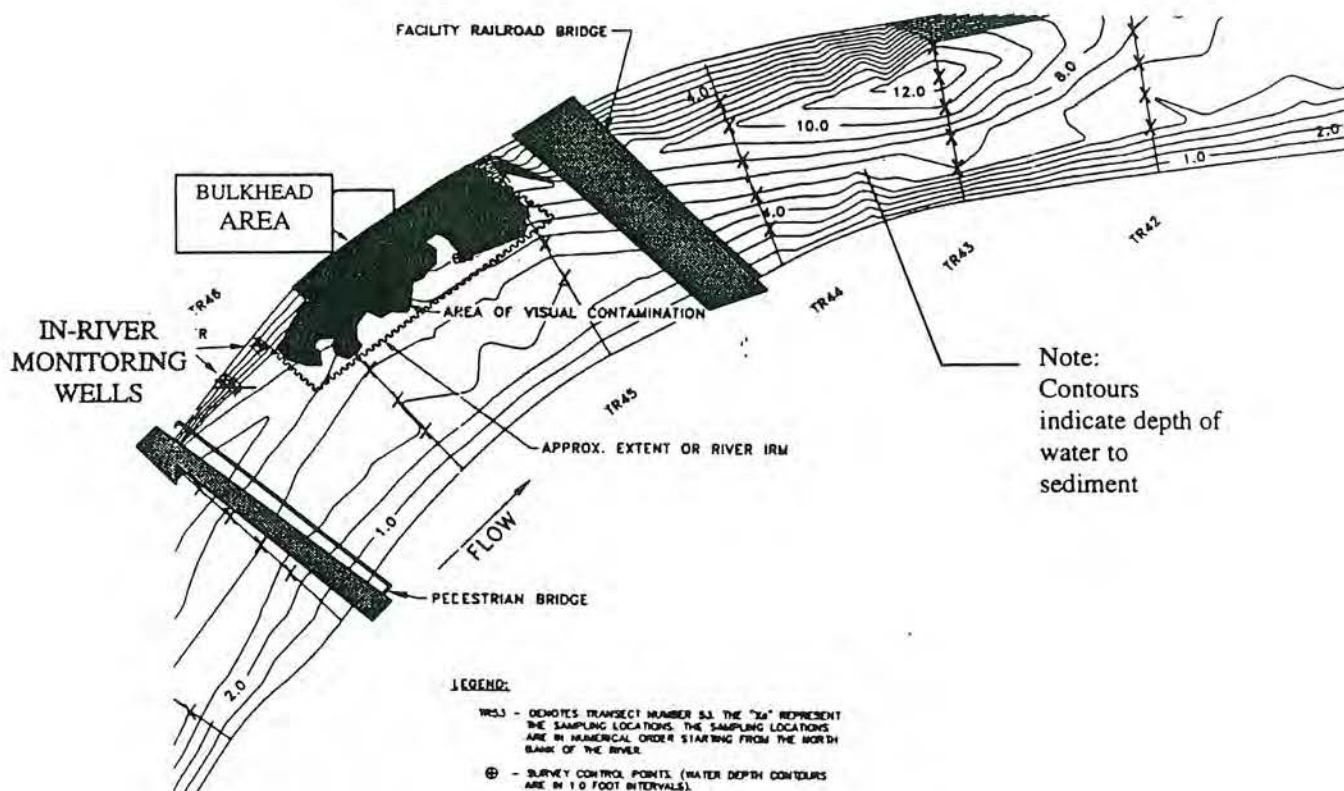
Measures will be taken to protect the water column by installing containment prior to the remedial activities. The removed material will require dewatering/stabilization prior to off-Site disposal. A request for discharge will be made to the local POTW regarding treated wastewater generated during removal and material handling activities.

Following the removal activities the area will be backfilled and all containment structures removed as part of Site restoration.

1.4 Methods

The Cofferdam IRM will be implemented by the mass removal of visually contaminated River sediments from the area in and around the former Cofferdam. The contaminated sediments will be removed from an approximately 50 feet by 145 feet area of River bed to a depth of 6 feet. The area of visually contaminated River sediment was delineated both horizontally and laterally during the RFI (Figure 1.3).

FIGURE 1.3 LOCATION OF VISIBLE CONTAMINATION



The Cofferdam IRM is being performed for mass removal of the target source area, as opposed to attaining a concentration based clean-up standard. Ciba proposes that the target area to be addressed by this Cofferdam IRM will be contained within sheet piling. A sealable sheet piling system will be utilized to divert the River flow in order to minimize the impact on the surrounding water column. A silt curtain will be installed to temporarily protect the water column during the sheet piling installation. Provisions will be made for wastewater treatment

during removal operations. Note that the removal methods and other details are subject to change upon submittal of the performance-based bids, as discussed in Section 5.0.

Sediments generated during removal activities will require dewatering/stabilization to remove free liquid so the material will pass a paint filter test suitable for off-Site disposal. Treatability testing will be performed prior to IRM implementation to determine the optimal method for solids dewatering/stabilization. Water generated during the dewatering and material handling operations will require treatment prior to POTW discharge.

The area will be backfilled with a suitable material that will inhibit re-contamination. A witness barrier (e.g., geotextile) will be installed at the limit of the IRM to provide a barrier between the surrounding River sediments and the backfill material to document the extent of the sediment removal.

SUMMARY OF DATA IN THE FORMER COFFERDAM AREA

2.1 General Site Characteristics

The former Cofferdam area is located on the facility side of the Pawtuxet River between the Site railroad bridge and the foot bridge (Figure 1.3). The foot bridge is located up-stream of the Cofferdam area. The vehicle/railroad bridge is located down-stream of the work area.

2.1.1 River Classification and Use

The Pawtuxet River has been divided into sections according to water quality standards and classifications established by RIDEM. The sections may be classified as freshwater Class A, B, C, D, or E. Class A waters are suitable for drinking water supply and all other uses. Class B waters are suitable for water supply with appropriate treatment prior to distribution, for agricultural uses, for bathing and other primary contact recreational activities, as well as fish and wildlife habitat. Class C waters are suitable for boating and other secondary contact recreational activities, for fish and wildlife habitat and for industrial processes (i.e., non-contact heat exchange fluids). Class D waters are suitable for the migration of fish and have good aesthetic value. Class E denotes nuisance conditions and use is limited to certain industrial processes, cooling, power generation and navigation. Classes D and E are used merely to describe existing conditions and are not considered an acceptable goal for the management of any water course.

The main stem of the Pawtuxet River is Class C above the Cranston Sewage Treatment Plant (River Mile 4.5). Below the Cranston Sewage Treatment Plant, the classification changes from Class C to Class D. For orientation purposes, the Bay is at River Mile 0, and the Site is at River Mile 2.3.

2.1.2 General Water Quality

The US Geological Survey (USGS) monitored water quality at two locations in the Pawtuxet River over a ten year period, from 1978 to 1988. Samples were collected at the Cranston Gauge Station (upstream of the Site) and at the Warwick Avenue Bridge (just downstream of the Site). The information was used to summarize the general water quality of the River in the vicinity of the Site, as shown in Table 2.1.

TABLE 2.1 GENERAL WATER QUALITY OF THE PAWTUXET RIVER

Water Quality Parameter	Units	Upstream Result (Avg.)	Downstream Result (Avg.)
Specific Conductance	uS/cm	227.7	262.3
Total Dissolved Solids	mg/l	58	No Data
Total Suspended Solids	mg/l	10.6	11.2
pH	SU	6.44	6.48
Turbidity	NTU	2.37	2.60
Temperature	oC	12.4	12.6
BOD	mg/l	2.55	5.62
COD	mg/l	29.8	33.9
Dissolved Oxygen	mg/l	9.08	8.01
Hardness	mg/l CaCO ₃	37.8	44.8
Alkalinity	mg/l CaCO ₃	17.1	22.9
Total Ammonia (as N)	mg/l	0.826	1.37
Nitrate/Nitrite	mg/l	0.622	0.780
Total Phosphorous	mg/l	0.358	0.507
TOC	mg/l	7.13	10.96

Source: USGS 1990. Water Resources Investigation Report 90-4082

The general water quality is greatly influenced by three domestic wastewater treatment system plants located upstream of the Site, as shown by elevated nitrogen and phosphorous concentrations in the water column.

2.2 Cofferdam Area

A cofferdam was used as a solids separation system for process wastewater directly discharged to the Pawtuxet River until 1972. The process wastewater discharge was eliminated in 1972 from this area and re-directed to an on-site wastewater treatment system.

A sheet pile bulkhead exists along the Site side of the former Cofferdam area. Currently, the Groundwater Stabilization IRM, designed to contain contaminated groundwater beneath the former Production Area from discharging to the River, is being constructed. The Groundwater Stabilization IRM should be operational by September 1995, prior to starting the Cofferdam IRM.

The River depth through the area of removal ranges between 0 to 7 feet deep, with an average of approximately 4 feet. Sediment dredging occurred in this area at the time that the Cofferdam was removed. Several in-river monitoring wells, installed during the RFI, are located upgradient of the area of visual sediment contamination (Figure 1.3).

2.3 Physical and Chemical Characteristics of Cofferdam Sediments

Several investigations of the current conditions of the River sediments have been performed as part of the RFI. The investigations have been used to determine the extent of the visual contamination within the former Cofferdam area and the physical and chemical characteristics of the sediment. These data show that the visually-impacted sediments contain contamination that represents discharges from past plant operations. However, samples of these sediments for RCRA waste classification indicate that the sediment to be removed is not RCRA hazardous, on the basis of current TCLP protocols (Table 2.2).

Analytical data collected from the previous investigations of the area are presented in tables 2.3 and 2.4. Sample designations and locations in the former Cofferdam area are presented in Figure 2.1.

TABLE 2.2 TCLP DATA FOR COFFERDAM AREA

Analyte	Regulatory Limit (mg/L)	SD-3(A,B,C) (mg/L)	SD-1-2(A,B,C) (mg/L)	SD-3C(0-0.5) (mg/L)	SD-2C(2-3) (mg/L)	SD-1C(0-1) (mg/L)	SD-3B(0-0.5) (mg/L)	SD-1B(1-2) (mg/L)	SD-3A(0-0.5) (mg/L)	SD-2B(0-1) (mg/L)	SD-1A(2-3) (mg/L)	SD-2A(1-2) (mg/L)
Volatile Compounds												
chlorobenzene	100	NA	NA	BDL	BDL	66	3.6	35	0.28	50	12	0.038
tetrachloroethene	0.7	NA	NA	BDL	BDL	BDL	0.04	BDL	BDL	BDL	BDL	BDL
Semivolatile Compounds												
1,4-dichlorobenzene	7.5	NA	NA	BDL	BDL	0.021	BDL	0.041	BDL	BDL	BDL	BDL
cresol	200	NA	NA	BDL	BDL	3.8	0.033	0.47	BDL	0.03	0.042	-
nitrobenzene	2	NA	NA	BDL	BDL	0.28	0.0049	0.016	BDL	BDL	BDL	BDL
Inorganics												
barium	100	0.46	0.83	0.36	0.43	0.46	0.53	0.33	0.39	0.53	0.72	0.49
Pesticides												
heptachlor	0.008	NA	NA	BDL	BDL	BDL	BDL	0.000035	BDL	BDL	BDL	BDL
endrin	0.02	NA	NA	BDL	BDL	BDL	BDL	BDL	BDL	0.00032	BDL	BDL

BDL = BELOW DETECTION LIMIT

TABLE 2.3 VOLATILE & SEMIVOLATILE ANALYTICAL DATA

Location Depth (feet)	SD-1-2(A,B,C)	SD-1B (1-2)	SD-1C (0-1)	SD-2A (1-2)	SD-2B (0-1)	SD-2C (2-3)	SD-3 (0-5)	SD-3A (0-5)	SD-3B (0-5)
Volatile Organics	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
2-butanone	BDL	BDL	BDL	BDL	BDL	1.2	BDL	1.2	1.4
acetone	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.2
benzene	63	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chlorobenzene	1200	910	14000	BDL	2700	2.8	0.012	0.27	BDL
chloroform	BDL	BDL	220	BDL	BDL	BDL	BDL	BDL	BDL
ethylbenzene	26	62	250	BDL	100	BDL	BDL	BDL	BDL
methyl ethyl ketone	60	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
methylene chloride	BDL	BDL	320	BDL	BDL	0.19	0.024	0.21	0.38
tetrachloroethane	BDL	BDL	200	BDL	BDL	BDL	BDL	BDL	BDL
toluene	510	400	11000	BDL	300	9.5	0.11	0.18	BDL
total xylenes	89	150	1300	150	302	0.51	BDL	BDL	BDL
Total Volatiles	1948	1522	27290	150	3402	14.2	0.146	1.86	2.98
Semivolatile Organics									
acenaphthylene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
anthracene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
benzo(a)anthracene	BDL	BDL	BDL	BDL	BDL	BDL	1.2	BDL	BDL
benzo(a)pyrene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
benzo(b)fluoranthene	BDL	BDL	BDL	BDL	BDL	BDL	1.3	BDL	BDL
benzo(g,h,i)perylene	BDL	BDL	BDL	BDL	BDL	BDL	0.46	BDL	BDL
benzo(k)fluoranthene	BDL	BDL	BDL	BDL	BDL	BDL	0.45	BDL	BDL
bis-2-ethylhexylphthalate	BDL	BDL	BDL	BDL	BDL	BDL	1.4	BDL	BDL
chrysene	BDL	BDL	BDL	BDL	BDL	BDL	1.1	BDL	BDL
di-n-octylphthalate	BDL	BDL	BDL	BDL	BDL	BDL	2.8	BDL	BDL
di-n-butylphthalate	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
fluoranthene	BDL	BDL	BDL	BDL	BDL	BDL	2.3	BDL	BDL
indeno(1,2,3-cd)pyrene	BDL	BDL	BDL	BDL	BDL	BDL	0.48	BDL	BDL
naphthalene	72	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
o-dichlorobenzene	180	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
p-chloroaniline	600	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
phenacetin	BDL	BDL	BDL	BDL	BDL	BDL	0.92	BDL	BDL
phenanthrene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
pyrene	BDL	BDL	BDL	BDL	BDL	BDL	1.7	BDL	BDL
Total SVOC	852	BDL	BDL	BDL	BDL	BDL	14.11	BDL	BDL

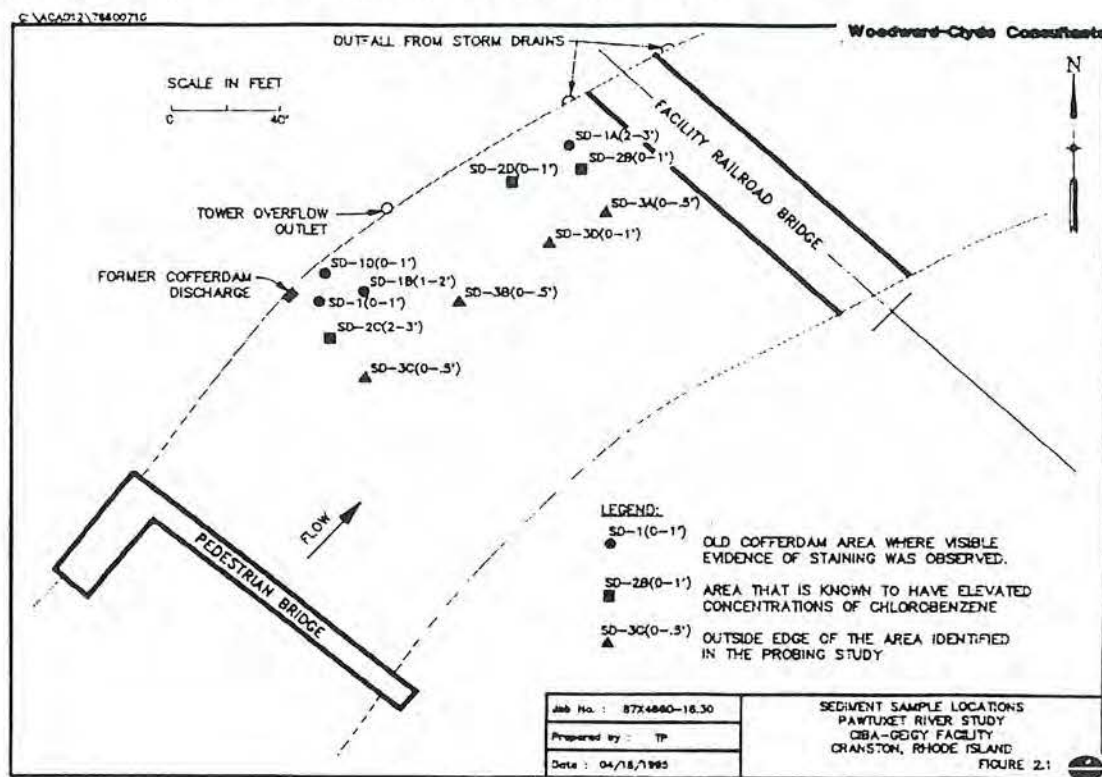
Note : BDL = BELOW DETECTION LIMIT

TABLE 2.4 PESTICIDES & PCB DATA

Location Depth	SD-1-2 (A,B,C)	SD-1A (2-3)	SD-1B (1-2)	SD-1C (0-1)	SD-2A (1-2)	SD-2B (0-1)	SD-2C (2-3)	SD-3 (0-5)	SD-3A (0-5)	SD-3B (0-5)	SD-3B (1-2)	SD-3C (0-5)	SD-3C (1-2)	SD-4B (0-5)
Pesticides/PCBs	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
4,4'-DDE	0.094	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1221	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.26
1232	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.076	BDL	BDL	BDL	BDL
1242	BDL	10	24	120	33	5.3	1.8	BDL	0.049	0.12	0.12	0.1	BDL	BDL
1248	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.38
1254	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.21	BDL	BDL	2.3	0.08
1260	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.032
Total PCBs	0.094	10	24	120	33	5.3	1.8	0	0.049	0.406	0.12	0.1	2.3	0.752

Note: BDL = BELOW DETECTION LIMIT

FIGURE 2.1 SAMPLE LOCATIONS IN THE COFFERDAM AREA



2.4 In-Situ Waste Classification

Additional data will be collected to fill in data gaps for waste characterization purposes so the material will be preclassified prior to removal activities.

Waste classification samples will be collected and analyzed prior to the start of removal activities. The proposed waste classification samples will be biased according to the area of visual contamination for the source area as illustrated on Figure 1.3.

In the event that the in situ waste classification program identifies "hot spots", or limited areas of RCRA contaminated sediments, these areas will be targeted for discrete removal and processed separately from the other non-RCRA sediments. This process is further described in section 5.0.

Treatability studies will be performed on the visually contaminated sediments to be removed. The objectives of the treatability testing are to:

- Evaluate the suitability of the waste material for dewatering;
- Determine the required levels of reagents required for optimal liquid/solids separation;
- Determine the concentration of contaminants in the liquid phase created by dewatering to determine appropriate treatment technologies;
- Develop technical and financial information required for the implementation of the full-scale remediation.

The treatability testing will include bench-scale testing for filter press, centrifuge, vacuum separation and solidification testing. The results of the bench-scale testing will be used to design a cost-effective system and technical approach to the dewatering/stabilization of the removed material.

3.1 Filter Press Testing

Recessed-chamber filter presses have been used effectively to dewater sediments/sludges from rivers, lakes and ponds. Filter aids such as lime, polymers, volcanic ash, ferric sulfate, ferric chloride and diatomaceous earth are used to optimize liquid solid separation. Several dewatering agents will be investigated to select the most appropriate material to use in conjunction with the filter press bench-scale testing.

3.2 Centrifuge Testing

Two-phase high-volume centrifuges operate at extremely high gravitational forces to separate the solid phases from the effluent water phases. Centrifuge dewatering has been determined to be a very cost effective means of dewatering sludges on large remediation projects. The

advantage of this technology is the elimination of the need for additional bulking agents, resulting in reduced solid volumes for off-Site disposal.

3.3 Vacuum Separation

Vacuum separation has been used effectively for treatment of materials such as domestic wastewater sludges. This technology will be assessed for the Cofferdam sediments.

3.4 Solidification Testing

Solidification involves the addition of a variety of stabilization reagents known to be effective for the solidification of sludges. The stabilization reagents to be tested will include Portland cement, flyash, cement kiln dust, lime kiln dust and formulations of a combination of stabilization reagents.

3.5 Supernatant Analysis and Treatment Technology Selection

In order to select the most appropriate technology for wastewater treatment from the stabilization effort, analysis will be performed on the filtrate and supernatant derived from the sediment stabilization testing. The appropriate technology will be selected to meet all applicable permit discharge limitations to the POTW.

The treatability testing will result in the design of a cost-effective system and approach to treatment. This will also facilitate the design of a dewatering system to accelerate project timetables while reducing both unit and overall costs of materials handling and disposal.

The results of the treatability testing are incorporated in Appendix A.

IDENTIFICATION OF PERMITTING REQUIREMENTS AND INTERACTION WITH REGULATORS

Several federal, state and local permits are required to complete this IRM. The following is a list of permits which potentially will be required for the completion of this project.

- US Army Corps of Engineers (ACOE) Section 404 Permit
- 401 Water Quality Certification
- Rhode Island Department of Environmental Management (RIDEM) Freshwater Wetlands Permit
- City of Cranston Soil Erosion and Sediment Control Plan
- POTW Approval for the Discharge of Water from the Sediment Dewatering

4.1 Federal Permits

The ACOE has promulgated rules to regulate the discharge of dredged and fill materials into the waters of the United States under Section 404 of the Clean Water Act (CWA). A Section 404 permit will be required to remove the sediments from the River.

To facilitate the remediation of contaminated sediments, the ACOE has promulgated nationwide permit (NWP) No. 38. NWPs provide a streamlined permitting process for projects with minor environmental impacts. NWP No. 38 authorizes the discharge of dredged or fill materials into the waters of the United States and work in navigable waters for the cleanup of contaminated sediments.

In order to be eligible for this NWP, the work must be ordered, performed or sponsored by a government agency. If this project is not sponsored or performed under the supervision of a government agency, it would not be eligible for a NWP. An individual permit would be required which requires significantly more time, effort and money to complete.

A 401 Water Quality Certification will also be required before the NWP will be considered valid. Since the IRM will result in the diversion of the normal flow of the River, certain additional conditions will apply. These conditions are a result of the potential adverse impacts which may be caused by the diversion and discharge of materials into the Pawtuxet River. If the impacts of the project are more than minor, mitigation may be required. The ACOE will determine in its discretion whether or not mitigation is required. A 401 Water Quality Certification is required for the Cofferdam IRM because of the potential adverse impacts which could be caused by the excavation activities.

4.2 RIDEM Permits

Rhode Island regulates work in rivers and in wetland areas under its freshwater wetlands protection regulations. The installation of sheet piling, the diversion of the flow of the water and the removal activities for the Cofferdam IRM will all require a permit or an exemption. These activities are considered alterations of a wetland under the regulations.

The wetlands permitting process is quite rigorous. The regulations provide an exemption for the remediation of contaminated sediments; however, the project must be under the direct oversight and/or control of the RIDEM Division of Site Remediation. This exemption requires the submittal of a work plan, which identifies the proposed activities and their impacts, to the Division of Freshwater Wetlands (Wetlands) for review. If the project is not under the direction or control of the RIDEM Division of Site Remediation the permitting process would be more involved.

4.3 City of Cranston Permits

The City of Cranston may require a Sediment Control permit to perform the Cofferdam IRM. The soil erosion ordinance for the City of Cranston requires that a plan be submitted that demonstrates how the project will be managed to control erosion and sedimentation.

4.4 POTW Permit

Water generated during the Cofferdam IRM will have to be treated and disposed appropriately. Ciba is currently petitioning the local POTW to allow for the discharge of treated wastewater from the groundwater stabilization IRM project. It is anticipated that Ciba will petition the POTW to allow for discharge of the water generated from the

dewatering/stabilization of the sediment proposed in this IRM. Table 4.1 presents the proposed treatment limitations for the temporary wastewater treatment system.

TABLE 4.1 Proposed performance Standards - POTW Discharge

Aqueous-Phase Treatment	Maximum
PARAMETERS	Discharge Limitations (mg/l)
Antimony	0.05
Arsenic	0.10
Beryllium	0.005
Boron	1.0
Cadmium	0.04
Chromium	0.4
Copper	1.0
Cyanide	0.3
Iron	0.2
Lead	0.3
Manganese	2.0
Mercury	0.005
Nickel	0.7
Phenols	1.0
Selenium	0.01
Silver	0.1
Thallium	0.005
Zinc	1.0
Total Toxic Organics	2.13
Oil & Grease	
Petroleum	25.0
Animal/Vegetable	100.0
pH	
Maximum	9.5
Minimum	5.5

Note: All Metals Expressed as Totals

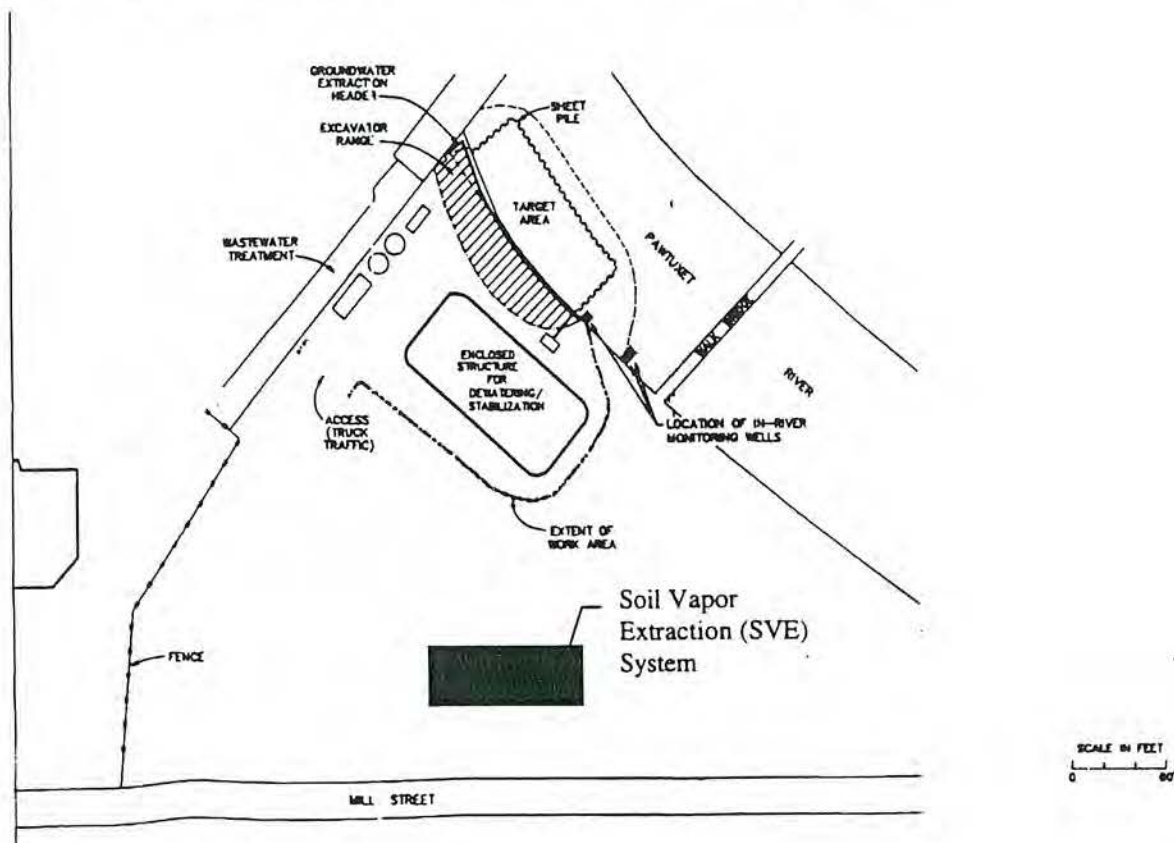
4.5 Waste Management Requirements

The sediment generated from the Cofferdam IRM will be handled in accordance with all appropriate disposal requirements.

Sediments generated during the Cofferdam IRM are likely to be covered by Department of Transportation (DOT) Hazardous Materials Shipping Regulations. As a result they must be packaged and shipped in accordance with DOT HM-181 requirements.

The Cofferdam IRM will be developed on the basis of a performance specification. It will be the contractors responsibility to design each component necessary to complete the project. The design and components of the Cofferdam IRM will be in compliance with all applicable laws and regulations. The IRM design will also be technically and economically feasible, as well as protective of human health and the environment. A conceptual depiction of the generalized IRM layout is shown in Figure 5.1.

FIGURE 5.1 GENERALIZED LAYOUT OF THE COFFERDAM IRM



The contractor will be required to write a detailed operations plan to facilitate the implementation of the Cofferdam IRM. The components of the Cofferdam IRM will include at a minimum details and responsibilities regarding the following:

- Permit Compliance

- Waste Characterization
- Treatability Studies Incorporation
- Evaluation of Local Hydraulics of the Pawtuxet River
- Site Preparation
- Temporary Wastewater Treatment Plant
- Silt curtain
- Temporary Sheet Pile
- Odor Control
- Removal and Staging Visually Contaminated Sediment
- Sediment Dewatering/Stabilization
- Sediment Transportation and Disposal
- Backfill and Site Restoration

5.1 Permit Compliance

As stated in Section 4.0 permit acquisition is the most important component to the timely completion of the Cofferdam IRM. This process will be simplified if sponsorship by a regulatory agency is obtained.

Primary responsibility for permit compliance will be on the part of the contractor, based on the performance bidding process. Ultimate responsibility for permit compliance will be on the part of Ciba.

5.2 Waste Characterization

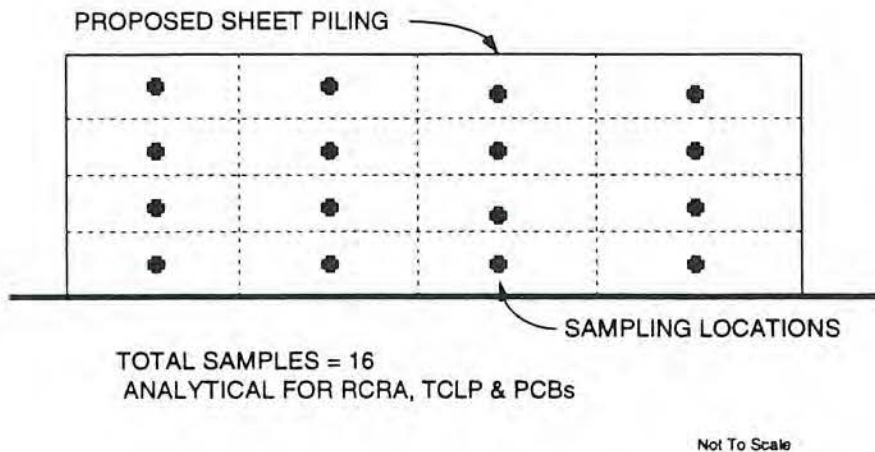
Waste characterization is a significant component of the Cofferdam IRM. The visually contaminated Cofferdam sediment will be pre-classified prior to start of work. This will be used for confirmation of non-RCRA hazard classification, delineation of RCRA "hot spots" (if applicable), and disposal facility acceptance for waste disposal.

Waste classification samples will be collected and analyzed before the start of sediment removal activities. Proposed waste classification composite sampling locations are shown in Figure 5.2. These proposed sampling locations may change based on actual conditions encountered in the field. The sampling scheme will be as follows:

- A survey will be performed to establish a grid for proper future identifications of hot spots;

- One sample representative of approximately 100 cubic yards;
- Samples from the Cofferdam area will be collected from 0.5 to 6.0 feet (or until refusal) below the River bottom because previous studies have suggested that this is the vertical extent of visible contamination;
- All samples will be analyzed for RCRA characteristics, TCLP and total PCBs.

FIGURE 5.2 WASTE CHARACTERIZATION SAMPLING



5.3 Treatability Studies

The treatability testing will result in the design of a cost-effective system and approach to treatment of the contaminated Cofferdam sediment and wastewater. The selection of a treatment technique will be focussed on an approach that can be implemented on a large scale effectively and in a timely manner while reducing both unit and overall costs of materials handling and disposal.

5.4 Evaluation of Local Hydraulics of the Pawtuxet River

The proposed sheet pile containment will extend approximately 50 feet into the River, reducing the stream cross-section. As a result of flow restrictions in the Pawtuxet River during the IRM an evaluation of the River hydraulics has been performed. The evaluation was used with existing data to determine the hydraulic effects of the temporary sheet piling around the visually contaminated sediment in the River with respect to the erosion potential along the opposite bank and possible upstream effects. A model has been developed as part of the facility investigation to simulate erosional and depositional characteristics of the River. The hydraulic evaluation and modeling will be used to determine if shoreline protection on the opposite bank or other controls are required as part of the Cofferdam IRM. This evaluation will assist in the prediction of upstream impacts, as well as permitting requirements. The existing hydrodynamic and sediment transport model for the River has been used to perform this analysis.

The numerical grid used in the model was modified such that the flow diversion is realistically simulated. The model simulates steady-state flow in the River at four flow rates: 340, 680, 1200 and 2500 cubic feet per second (CFS), which correspond to mean flow, twice the mean flow, annual flood and 5 year flood, respectively. To provide a basis for comparison, the original model geometry, without the flow diversion, will be used to simulate steady-state flow in the River at the same four flow rates. The impact of the flow diversion is evaluated by computing the difference between predicted values, with and without the diversion, for the following quantities:

- Water Surface Elevation
- Current Velocity
- Sediment Bed Erosion

Modeling results is presented in the form of graphical plots of the spatial distributions of the various quantities being investigated. In addition, predicted water surface elevations with the flow diversion, are compared to estimated River bank elevations, based upon available data and maps, in an effort to determine at what flow rate the River would overtop its banks upstream of the obstruction.

The results of this analysis are presented in Appendix B.

5.5 Site Preparation

Site preparation will be required to construct many components of the Cofferdam IRM. This will include the grading and construction of areas for staging and equipment laydown, the temporary wastewater treatment plant, waste staging areas, sediment dewatering/stabilization areas, and Site access roads.

5.6 Temporary Waste Water Treatment Plant

A temporary wastewater treatment plant will be designed to treat water generated as a result of the dewatering/stabilization of the contaminated sediment from the former Cofferdam area. The wastewater will be characterized during the treatability studies, in order to design the treatment plant. Estimates of contaminant concentrations and volume of water to be treated will be required. The treatment plant may include multi-media filters, particulate filters, carbon treatment units, sampling ports, discharge tanks and backwash facilities. Emergency holding capacity will be included. The system will be designed by the successful contractor in accordance with the performance specifications within the bid documents. Treatment standards will be specified as per the City of Cranston Industrial Pretreatment Program Limitations, Table 4.1. Figure 5.1 shows the approximate location of the temporary wastewater treatment plant.

5.7 Silt Curtain

A silt curtain will be installed outside the area of visual River sediment contamination to limit any short-term turbidity problems that may result from the installation of sheet piling. The silt curtain will be designed to protect the water column during the sheet pile installation. The type of curtain will be specified by the successful contractor as per the performance bidding process.

5.8 Temporary Sheet Pile

Ciba proposes that steel sheet piling will be installed approximately 5 feet outside the limits of the 50 feet by 145 feet source material. A sealable sheet pile system is recommended with the following design criteria:

- Minimize the impact on the surrounding water column
- Facilitate the removal of visually contaminated sediment
- Minimize the potential for River water to infiltrate into the removal area

The depth, type, and support of sheet piling will be determined during the engineering design by the successful contractor as a result of the performance bidding process.

The sheet pile is intended to be a temporary structure that should be easy to install and remove. Proper sheet pile installation will reduce time associated with sediment removal, sediment dewatering/stabilization and wastewater treatment.

5.8 Initial Water Discharge

Before disturbing any sediment with any removal activity, Ciba proposes that the water from within the containment area be discharged directly to the River. This initial discharge will proceed until the water level within the containment area is approximately 1 foot from the sediment surface; all subsequent water generated will be treated through the temporary on-Site treatment system.

5.9 Odor Emission Control

In order to insure proper odor control practices are implemented, the performance bidding procedure will require that the successful contractor provide a portable structure within which all stabilization activities will occur. In addition, odor control measures may be required within the removal area. In the event that this is required, the successful contractor will supply some type of odor control media (i.e., foam) to minimize the generation of these odors.

Continuous air monitoring will be performed at the work area and periodically at the fence line of the property to ensure odor emission control measures are operating correctly.

5.10 Continuous Containment Area Dewatering

Regardless of the method of sediment removal, an inward hydraulic head will be maintained at all times by lowering the water level within the containment area. All water generated will be treated in a wastewater treatment system designed by the successful contractor as per the performance bidding process. It is anticipated that the discharge of the treated water will be allowed to be directed to the City of Cranston POTW. Current estimates of the necessary flow to maintain a negative pressure within the containment area are in the range of 200 gallons per minute (GPM).

5.11 Removal and Staging of Contaminated Sediment

A solids handling area will be constructed adjacent to the work area. This area will be enclosed by a portable structure supplied by the successful contractor of the performance

bid procedure. Secondary containment will be provided for the area to prevent the release of any materials to the surrounding environment.

In the event that RCRA classified material is identified during the waste classification sampling program (Section 5.2), the hot spot identified will be surveyed prior to removal operations. These materials will be removed and disposed of separately from the non-RCRA material.

5.12 Sediment Dewatering/Stabilization

The treatability study will assist in the design of a cost-effective system and approach for the dewatering/stabilization of the contaminated River sediment for off-Site disposal. The sediment dewatering/stabilization area will be constructed in such a manner to be protective of human health and the environment during material handling activities.

Odors from operations will be minimized via the use of foam within the removal area (if required) and other control device(s) as needed at the exhaust of the solids handling portable structure.

5.13 Sediment Transportation and Disposal

Following the dewatering/stabilization of the contaminated sediments the material will be loaded into dump trailers for off-Site disposal. A axle scale will be used to estimate the quantity of material loaded manifested off-Site per container. The sediment load-out area will also be constructed in such a manner as to protect the surrounding environment from accidental discharge. Provisions will be made to allow for the storage of empty trailers on-Site, as well as for at least two (2) full trailers for shipment the following day.

It is anticipated that two (2) to five (5) tractor trailer trucks will be loaded per day during removal operations. It should be noted that these estimates are preliminary and subject to change due to performance bid outcome, field conditions and other unforeseen circumstances.

5.14 Post-Removal Backfill and Site Restoration

Following the completion of the removal activities, the removal area will be restored to its original condition. A witness layer will be placed at the bottom of the excavation to provide a barrier between the remaining sediment and clean backfill. Backfill will be selected that will remain in place and resist re-contamination. Following the placement of

backfill, the sheet piles and silt curtain will be removed and the Site restored to its original condition. All materials shall be decontaminated and shipped off-Site. Areas of disturbed soil will be graded and the area seeded for erosion control.

5.15 Working Hours

It is anticipated that, in compliance with local ordinance, site operations during the IRM will be performed during the hours of 7:00 AM and 6:00 PM Monday through Saturday for duration of the project.

6.0
POTENTIAL ENVIRONMENTAL CONCERNS

One objective of the Cofferdam IRM is to complete the sediment removal and handling without increasing short-term (i.e. during the period of IRM performance) risks to human health and the environment. The IRM will be completed in a manner that will minimize the concerns of potential releases of contaminants to the local environment. Table 6.1 summarizes the potential concerns and the control measures that will be used to prevent releases. Also shown are some of the monitoring activities that will be used to evaluate the effectiveness of the control measures; monitoring is further detailed in Section 7.0.

TABLE 6.1 Summary of Potential Environmental Concerns and Controls

Potential Environmental Impacts	Control Mechanisms	Monitoring Requirements
River Water Quality	1. sheet pile containment 2. silt curtains 3. inward hydraulic gradient	continuous turbidity monitoring upstream and downstream
Air Emissions (including odor)	1. avoidance of over-drying sediments 2. material handling performed in an enclosed structure	air monitoring at work perimeter and site fence line
Accidental spills or releases	1. all work will be in restricted areas with appropriate containment 2. contingency plans	continuous observation
Direct Contact - Workers	1. personal protective equipment in accordance with Health and Safety Plan	continuous observation and monitoring
Direct Contact - Public	1. all work will be performed in restricted areas	security monitoring
POTW influent	1. Wastewater treatment plant designed to comply with pretreatment requirements	effluent monitoring